Horizon COMPACT™

Wireless Ethernet
Release 1.01.00

Product Manual – Volume 2
Version 1.2

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1.0 Introduction

Horizon Compact Manual Volume 1 describes the basic requirements for configuring, installing and aligning a Horizon Compact Ethernet link. Volume 2 (this Volume) provides more in-depth descriptions of the alignment procedure and explanations as to how the advanced configuration features, noted in Volume 1, are implemented. Detailed configuration examples are included.

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2.0 Aligning the Horizon Compact System

The alignment process is carried out in two stages. The first stage is to visually align the antennas. Once the antennas have been visually aligned, the second stage is to perform a detailed alignment, which involves adjusting the fine alignment mechanisms until a maximum received signal is obtained. This signal should be within ±3 dB of the expected signal level determined during the planning process.

2.1 Visual Alignment of the Horizon Compact Antennas

This section details how to align the Horizon Compact antennas visually.

Procedure 2-1
Align the antennas visually

Before attempting to visually align the Horizon Compact antennas, make sure that the aiming adjustment mechanisms (pan and tilt) on the mounting system are set to their mid positions. This ensures that there is adequate to and fro movement available from the adjustment mechanism for fine adjustment later. To visually align, loosen the clamping nuts and rotate the antenna assembly clamp on the mounting pole, then, securely tighten the clamp.

There are three methods that are recommended for visually aligning the antennas. In each case the use of signaling mirrors, on a sunny day, or a powerful flashlight for dull days, may greatly assist in locating the other end of a link.

1. **If the far end antenna site is visible**, aim the near end antenna towards the far end site as accurately as possible. The beamwidth of the signal is approximately 2 degrees (or less), which is approximately equivalent to a thumb's width when the arm is fully extended. Align as closely to the centre of the 2-degree beamwidth as possible. Clamp the radio/antenna mounting brackets in place on the pole/tower torquing the nuts to specification. See **Table 2-1** for torque values. Repeat this for the far end site. This should provide you with a signal strong enough to perform an accurate alignment later.
2. **If the far end antenna site is NOT visible (due to poor visibility), and the site locations appear on a map**, use a large scale map of the area and mark the positions of each end of the link. Draw a line on the map between each of the ends of the link. Locate a landmark which falls on the line that is visible from the near end and point the antenna to the landmark. Clamp the radio/antenna mounting brackets in place on the pole/tower torquing the nuts to specification. See **Table 2-1** for torque values. At the far end of the link locate a second landmark, visible from the far end, that falls on the line and align the far end antenna to that landmark. Clamp the mounting bracket as before. The antennas should be aligned sufficiently to obtain a signal strong enough to perform an accurate alignment later.

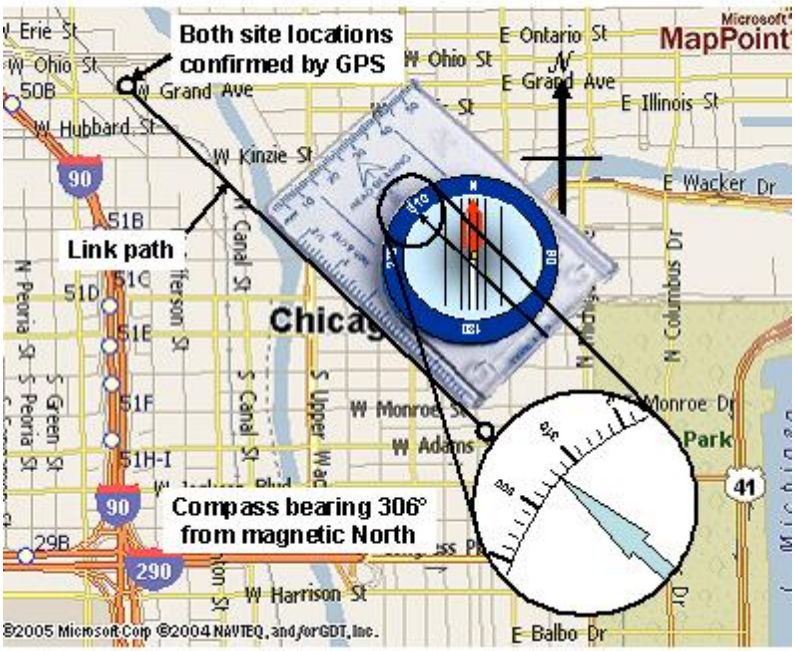
Table 2-1
Torque Specifications for Antennas

Bolt size (in inches)	Nut torque
¼	50 in-lb
5/16	102 in-lb
3/8	15 ft-lb
7/16	24 ft-lb
½	37 ft-lb
9/16	37 ft-lb

Figure 2-1
Aligning Antennas Using Local Landmarks

3. **If the far end antenna site is NOT visible (due to poor visibility), and there are no visible land marks**, use a GPS unit to obtain accurate coordinates for each end of the link. Plot these on a map of the area and draw a line between each site. Using a compass, physically align the map so that the magnetic North compass bearing marked on the map coincides with actual magnetic North shown on the compass. Use the compass to measure the bearing of the line drawn between each site relative to magnetic North. At each end of the ink, use this compass bearing to aim your antennas. Clamp the radio/antenna mounting brackets in place on the pole/tower torquing the nuts to specification. See **Table 2-1** for torque values. The antennas should be aligned sufficiently to obtain a signal strong enough to perform an accurate alignment later.

Figure 2-2
Using GPS and Compass Bearings to Align Antennas



This concludes the steps to align the radios visually.

2.2 Detailed Alignment of the Horizon Compact Antennas

This section describes how to perform detailed alignment of the Horizon Compact antennas.

Note: The Horizon Compact BNC Field Strength connector serves two purposes. It is used for alignment and for system redundancy purposes. When used for alignment it provides an output voltage of 1 mV DC per dB of signal strength. Connecting a digital voltmeter to this connector will provide you with a convenient way of measuring field strength and confirming antenna alignment. Use the CLI command **set alignment on** press Enter, to enable the field strength measuring option. When used for redundancy purposes ensure that the CLI command **set alignment off** is used.

The DragonWave Horizon Compact Web Interface may also be used for alignment. From the Home page, select Tools, then Link Alignment. The RSL readings displayed are continuously updated and the highest value reached is retained to facilitate the alignment procedure.

When you prepare to align the antennas, you must consider three important factors:

- The radiation pattern of the Horizon Compact antennas (main lobe and side lobes)

1. The need for a Clear Line of Sight (LOS)
2. The sensitivity of the alignment adjustment. See Section 2.2.3 for more details.

	Caution **Alignment of the Horizon Compact requires power to be supplied to the PonE and surge protector unit.**
	Caution **Proper alignment results in increased signal quality! Once the Horizon Compact units have been visually aligned, detailed alignment can begin. Pan across the entire beamwidth to ensure the alignment corresponds to the main lobe and not to a Side Lobe.**
	Caution **Transmission of radio signals results in a primary signal (main lobe) and secondary signals (side lobes) being sent towards the destination. During installation the side lobes can be mistaken for the main lobe, resulting in a 20-30 dB loss of signal strength. On a 12" / 30 cm antenna, the entire beamwidth typically lies within a 5–degree span so it is critical to ensure alignment targets the main lobe and not the side lobes. Larger antennas have a narrower beam. For a 24"/60 cm antenna, the entire beamwidth lies within a 3–degree span.**
	Caution **It is possible to get a "peak" reading during the antenna alignment process if one or both of the antennas is aligned on a side lobe. In such a case, the measured receive level may be 20 dB or more lower than the callculated value. Be aware that the link may still function under these circumstances. If the readings are within 2 - 4 dB of the calculated levels, then the antennas are most likely to be properly aligned.**

2.2.1 Radiation Pattern of Dish Antennas

Dish antennas radiate a primary signal (main lobe) and a number of secondary signals (side lobes). The main lobe is the strongest. When you align the radios, you must make sure to align to the main lobe of the signal. If you mistake the first side side lobe for the main lobe during installation, there can be a 20-30 dB loss of signal strength. For example, if the Calculated RSL = -42 dB then the side lobe would be at approximately -62 dB, or 20 dB lower than the calculated level.

Although in most cases only the first two side lobes are detected, depending on antenna size and the distance between sites, it may be possible to "see" several side lobes (see Figure 2-3). It is wise to pan the full 35 degrees available with the antenna alignment adjustment to locate all the lobes that may be present, so that the main lobe can be positively identified. As you pan through the signal, the side lobes will show up as peaks in the receive signal level (RSL), each peak getting stronger as you approach the main lobe. The main lobe will always be the strongest.

The size of the beamwidth for the Horizon Compact systems is approximately 2 degrees. Two degrees is approximately equivalent to a thumb's width when one's arm is fully extended. Align as closely to the centre of the 2-degree beamwidth as possible. It takes very little adjustment to swing past the main lobe, as can be seen in Figure 2-5. A beamwidth of 2 degrees is very narrow and alignment errors can occur when you lock on to a side lobe instead of onto the main lobe. If you align to one of the side lobes, your signal strength will be reduced. Make sure you align the antenna to the main lobe.

Note: Verify the RSL is within 2 – 4 dB of the calculated value.

Figure 2-3 Main and Side Lobes

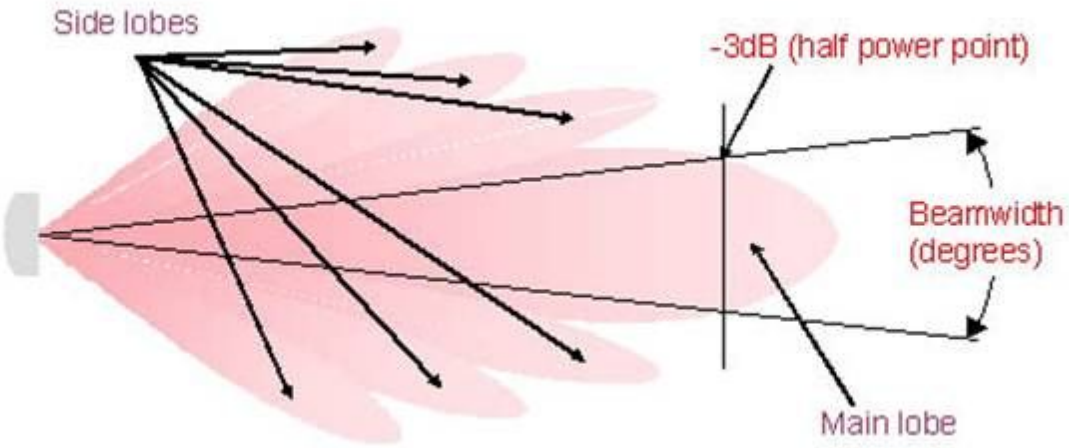


Figure 2-4 Typical main lobe coverage using 23 GHz Radio with 24” antenna

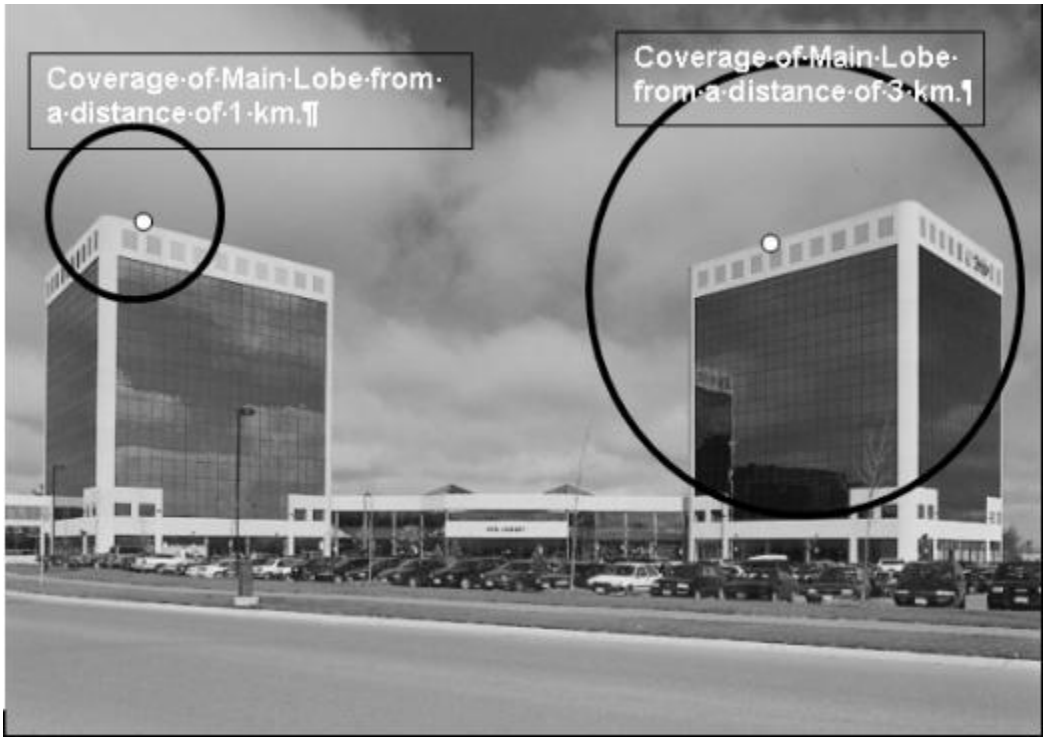


Table 2-2 Approximate size of beam at destination

Beamwidth	1 km	3 km	5 km	8 km	10 km
2˚ (18/24” antenna)	35m	105m	175m	280m	350m
1.3˚ (36” antenna)	23m	68m	114m	182m	227m
1˚ (48” antenna)	18m	54m	90m	144m	175m

Figure 2-5
Main lobe and side lobes (distance of approximately 4 km)

2.2.2 Avoid the Fresnel Zone

The Fresnel zone is an area of the antenna radiation pattern that lies mid way between the two system antennas. The size of this area is dependant upon the frequency being used and the distance between antennas. You should avoid having any obstructions within the Fresnel zone. Note that you may be able to see the far end antenna without obstruction, but still have obstacles in the Fresnel Zone. Signal quality will deteriorate if obstacles encroach too deeply into the Fresnel zone. Encroaching up to the 60% mark is acceptable.

Figure 2-6 WRONG! Obstruction of the Fresnel Zone

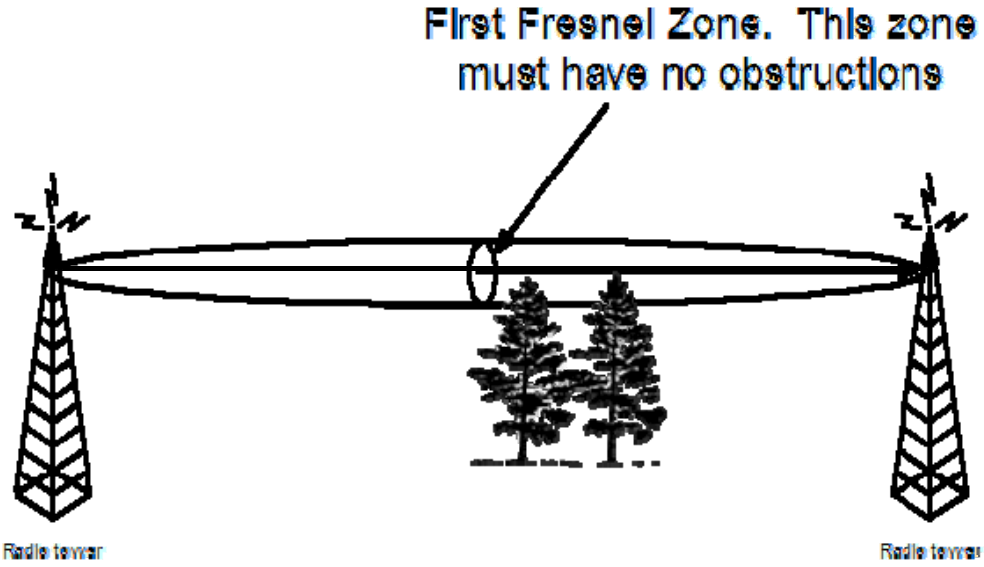
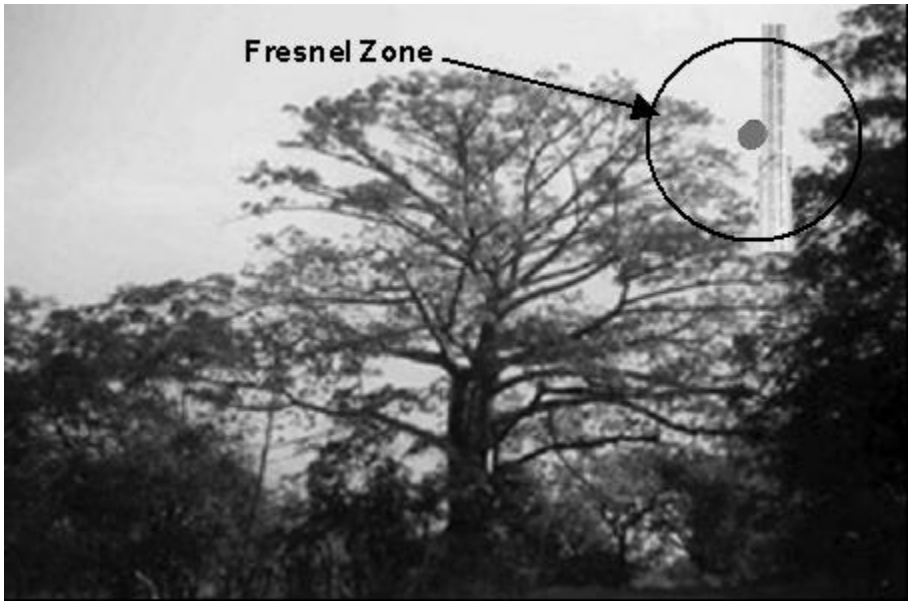


Figure 2-7 WRONG! Trees within the Fresnel Zone Obstruct the Signal



2.2.3 Alignment Adjustment Sensitivity

When aiming the antenna it cannot be over emphasized that you must rotate the adjustment nut(s) 1/10th of a turn at a time between taking RSL readings (allow time for the RSL reading to update). Table 2-3 shows how many degrees the antenna will move when the adjustment nut(s) is rotated through one full turn.

Table 2-4 shows that the beam width of the typical antenna is often less than the amount of movement available with one full turn of the aiming adjustment.

Table 2-3 Degrees per Revolution of Adjustment

Antenna Size	Change in Elevation (Tilt)	Change in Azimuth (Pan)
12" and 24"	2.2 º per full turn of adjustment	1.6 º per full turn of adjustment
36" and 48"	1.3 º per full turn of adjustment	1.1 º per full turn of adjustment

Table 2-4 Antenna Specifications – Selected radios

Antenna Size	18 GHz Horizon		23 GHz Horizon	
	Beamwidth of main lobe (degrees, 3 dB)	Gain dBi	Beamwidth of main lobe (degrees, 3 dB)	Gain dBi
30 cm/12"	3.0 degrees	34	2.7 degrees	35.1
60 cm/24"	2.0 degrees	38.6	1.7 degrees	40.2
90 cm/36"	1.3 degrees	42.0	1.1 degrees	43.7
120 cm/48"	1.0 degrees	44.5	0.8 degrees	46.2

2.3 Locating Horizon Compact Antennas

In addition to ensuring that you have a clear line of sight (LoS) between antennas and that there are no obstructions encroaching into the Fresnel zone, you must pay attention to the location of antennas relative to objects located close by.

The antenna must be positioned in such a manner as to ensure that obstacles in close proximity to the antenna do not interfere with the near field RF radiation from the antenna (near field effects). Close proximity obstacles can cause reflections and severe interference with communications between radios. This is especially critical for the 24 GHz Unlicensed frequency band, where radios are cross polarized. Transmit signal reflections change polarity and can be "swallowed" by the receiver, causing swamping and poor quality reception.

Note that the edge of a roof (roof line) must be considered an obstacle.

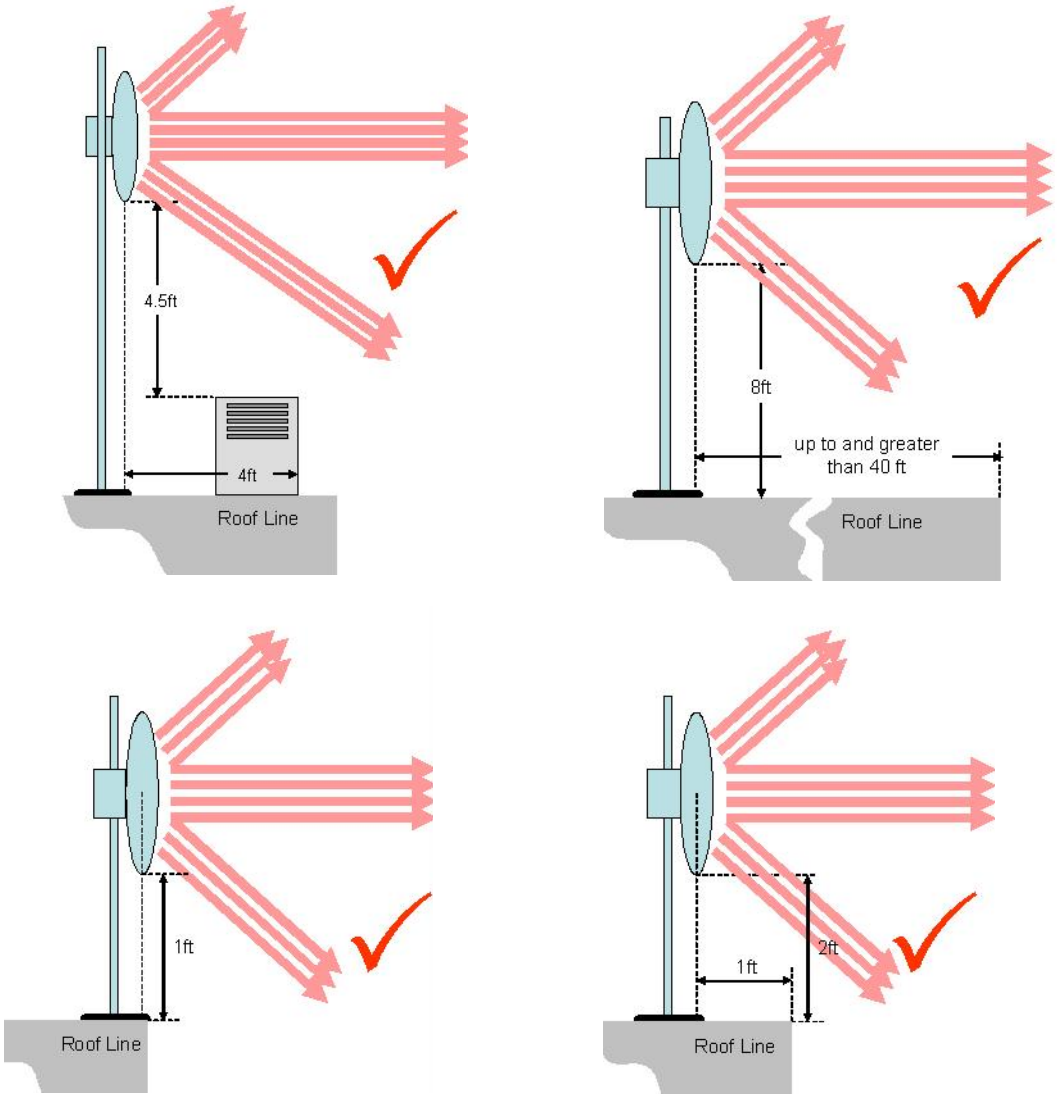
Table 2-5 shows the minimum antenna height requirements above obstacles for the 24 GHz Unlicensed frequency band.

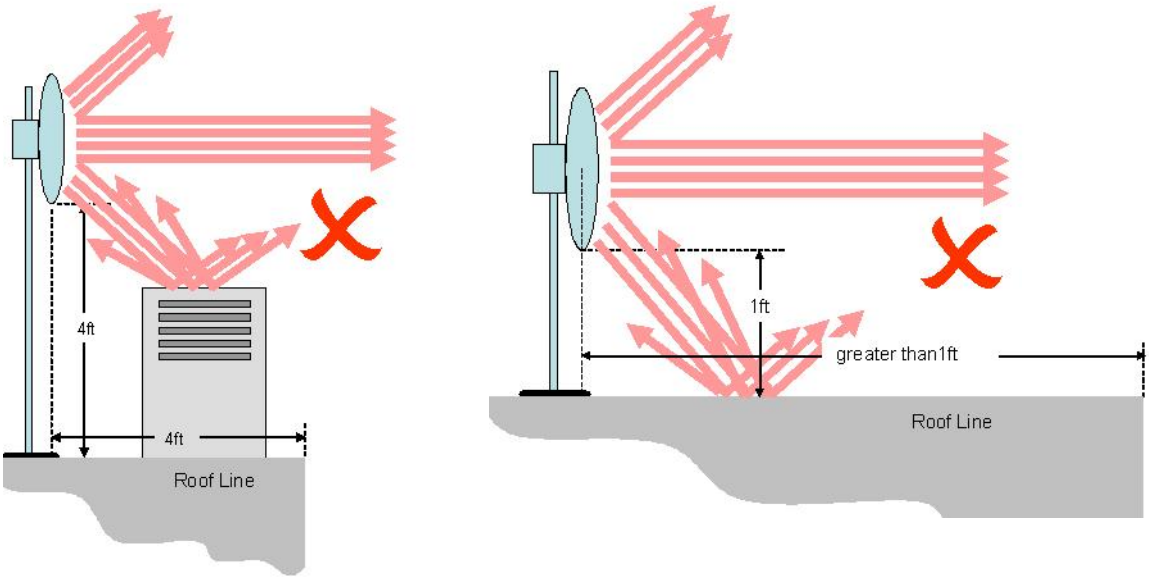
Table 2-5 Antenna Height vs Obstacle Distance for 24 GHz Unlicensed

Distance from Obstacle (ft)	0	1	2	3	4	5	6	7	8	9	10	20	30	40	>40
Minimum Antenna Height above Obstacle (ft)	1	2	3	4	4.36	4.46	4.55	4.64	4.73	4.82	4.91	5.82	6.73	7.64	8

The following figures illustrate examples of correct and incorrect antenna location.

Figure 2-8 Correct & Incorrect Antenna location





Near field effects are also experienced above and on each side of the front of an antenna. Ensure that these areas are also free of obstructions.

3.0 Advanced Configuration Features

Volume 1 describes the configuration of the basic features that allow the Horizon Compact to provide a wireless Ethernet link, with a throughput of up to 400 Mbps. A number of advanced configuration features provide enhanced access and management security, link protection, quality of service and alarm management. Each advanced feature is described in detail in the following sub-sections.

3.1 RADIUS Server User Authentication

The DragonWave Remote Authentication Dial In User Service (RADIUS) server option enables users to be centrally authenticated before being allowed access to a modem. This adds another layer of security by removing user access control away from individual modems and moving it to a central server. However, all modems must have all approved users entered in the modem user authentication list before the system will grant access at the appropriate user levels (admin, NOC, Super).

Up to five (5) RADIUS servers can be configured.

When one, or more, RADIUS server is configured, the username and password authentication system on the modem is bypassed, in favour of the RADIUS system. Access levels are still retained in the local modem memory, so once a user is verified by the RADIUS server the access level is assigned by the modem (provided that that user is a valid user on that modem). Any user that is validated by the RADIUS server, but is not found in the modem user authentication list, can gain access to the modem but only at an admin user level.

If, on attempting to log in, a user does not receive a response from a configured RADIUS server, the user will not be allowed to log in. This could be the case if the server was off line. However, the system can be configured to allow the Super user to still access the modem via the local modem access control, even when a RADIUS server does not respond.

Only the Super user can issue any of the RADIUS “set” commands and view any of the security related entries returned with “get” commands (passwords, shared key etc..)

Procedure 3-1
RADIUS Server User Authentication

Use this procedure to set up user authentication using a RADIUS server and enable the Super user to access a modem if the RADIUS server does not respond.

Note: To perform this procedure, you must be logged into the system as the Super user.

Required Action	Steps
login	Log in using the Super user account.
get radius servers	Returns a list of RADIUS servers already configured on the system. Sequence: **get radius servers** press Enter The system responds: *index active_host active_key cfgd_host cfgd_key* *===== ========== ========== ========== ==========* *1 192.168.1.48 testing123 192.168.1.48 testing123* *2 192.168.1.20* *3* *4* *5* Note that the second radius server is not active because the radius key has not been configured.
set radius server host	This command sets up a RADIUS server host. Note that once the RADIUS server host details have been entered, the server key has to be entered before the server becomes active (see next command). Sequence: **set radius server host [index] [ip address]** press Enter Where [index] is the server index 1…5 and [ip address] is the ip address of the RADIUS server concerned The system responds: *Host set. When server Host and Key are set,* *'save mib' and 'reset system' for changes to take effect*

Required Action	Steps
set radius server key	Adds the required shared key to the RADIUS server host configuration. Note that the previous command has to be issued and the server key entered before the RADIUS server will become active. Sequence: **set radius server key [index] [someString]** press Enter Where [index] is the server index 1…5 and [someString] is an alpha-numeric string of up to 32 characters in length. The system responds: *Key set. When server Host and Key are set,* *'save mib' and 'reset system' for changes to take effect*
get radius servers	Check that servers have been set up correctly by issuing this command Sequence: **get radius servers** press Enter The system responds: *index active_host active_key cfgd_host cfgd_key* *===== ========== ========== ========== ==========* *1 192.168.1.48 testing123 192.168.1.48 testing123* *2 192.168.10.51 password4* *3* *4* *5* Note that the second host is not yet active as the sytem has not been reset. After a system reset the ip address and key will be repeated under the active host and active key columns.

Required Action	Steps
set radius super user authentication	This commands enables or disables the Super user from accessing a modem, when the RADIUS server does not respond, or is not available. If set to “off” the Super user is allowed to log in using the name and password set in the modem. The default setting is “off”. Sequence: **set radius super user authentication strict [on/off]** press Enter The system responds: *Radius authentication for Super User is now [strict/not strict]* A save mib command will make this command effective immediately. WARNING: If super user authentication is set to ON, and the Super user name and password are not entered into the RADIUS system, the Super user will not be able to regain access to the modem after a reset.
get radius super user authentication strict	This command returns the status of the radius super user. Sequence: **get radius super user authentication strict** press Enter The system responds: *Radius authentication for Super User is [strict/not strict]* *(not strict means SU flash password still works under Radius)*
save mib	Saves the MIB to RAM. Perform this command to save setting changes to non-volatile memory. Sequence: **save mib** press Enter The system responds: *MIB saved successfully.*
Reset system	A system reset is required to activate this feature. Sequence **reset system** press Enter The system responds: *Are you sure you want to reset? Y(yes) or N(no)* press **Y** The system will proceed to reset. You will have to log on again to regain access.

3.2 Management VLAN Tagging

3.2.1 VLAN Tagging Overview

A Local Area Network (LAN) is a single–broadcast domain. If a user broadcasts information on the LAN, every other user on the LAN receives the broadcast. A router prevents broadcast messages from leaving a LAN. The result is a reduction in the number of collisions and an improvement in performance.

A network manager can create smaller broadcast domains and reduce network broadcasts by logically segmenting a LAN into different broadcast domains. These broadcast domains are called Virtual Local Area Networks (VLANs). Workstations on a VLAN do not have to be physically located together because they are segmented logically and not physically.

VLANs offer a number of advantages over traditional LANs including:

- performance
- security
- formation of virtual workgroups
- cost reduction

All ports on a switch are configured for a default VLAN (usually VLAN1). When a switch receives data from a workstation, the switch tags the data with a VLAN identifier that indicates the originating VLAN. The switch sends the data to the ports inside the VLAN where the data originated. The switch also sends the data to a trunking port if one is available.

Network Administrators create VLAN groups and place backbone network devices into the VLAN group to simplify administration and increase security of the devices. VLAN tagging allows network administrators to add Horizon Compact nodes to the administrative network. VLAN tagging restricts administrative access to devices that are members of the VLAN group.

3.2.2 802.1Q Tagging

VLAN Standard: IEEE 802.1q Draft Standard. The Institute of Electrical and Electronic Engineers (IEEE) is working on a draft standard 802.1q for virtual local area networks. Currently, most products are proprietary. This means that if you wish to install VLANs, you may have to purchase all products from the same vendor. DragonWave implements Horizon Compact VLAN Tagging using the IEEE 802.1q standard. For more information on the Standard, see the Web page:

http://grouper.ieee.org/groups/802/1/pages/802.1Q.html

3.2.3 VLAN Tagging Implementation in Horizon

Note: The configuration of Horizon Compact VLAN tagging is only necessary if you wish to restrict management communications to a Horizon Compact to a specific management VLAN.

The Horizon Compact system will pass user VLAN traffic transparently, independent of the Horizon Compact VLAN settings. The VLAN settings are for Horizon Compact management purposes and do not affect user data or traffic. Note that the Horizon Compact system handles Ethernet packet sizes up to 9600 bytes.

There are three parameters associated with Horizon Compact VLAN tagging:

1. Enable or disable VLAN tagging (set VLAN tagging [on/off])
2. Identify the VLAN tag id to be used with Horizon Compact (set VLAN tag [tag id])

3. Determine whether to allow Horizon Compact to match the VLAN settings in response to incoming packets, or whether to restrict responses to those incoming packets containing the programmed VLAN tag. There are two modes (set network protocol strict [off/on]) which are commonly known as “friendly” and “strict” mode.

    i. **“Friendly” mode.** In this mode, Horizon Compact matches the VLAN format of the incoming packet. If an incoming packet contains a VLAN tag, then Horizon Compact responds with a VLAN tag matching the incoming packet. If the incoming packet does not contain a VLAN tag then Horizon Compact does not insert a VLAN tag in the response. Packets generated by Horizon Compact (e.g. SNMP traps) will contain the programmed VLAN tag.

    ii. **“Strict” mode.** Horizon Compact will only respond to packets containing the programmed VLAN tag. All other packets will be ignored. Packets generated by Horizon Compact (e.g. SNMP traps) will always contain the programmed VLAN tag.

3.2.4 Horizon Compact VLAN Settings

The following tables describe the behavior of Horizon Compact management packets with respect to VLAN settings on the Horizon Compact system.

Table 3-1
VLAN Configuration: Network Protocol Strict is OFF. VLAN tagging is OFF

Horizon Compact management is set to "friendly" mode due to network protocol strict being set to OFF. In this configuration Horizon Compact will not generate or respond to VLAN packets.

Condition	Horizon Compact Outgoing Packet
Horizon Compact incoming packet does NOT contain a VLAN tag	Horizon Compact responds to the packet. There is no VLAN tag inserted.
Horizon Compact incoming packet contains a VLAN tag	Horizon Compact inserts VLAN tag in the response in order to match the VLAN tag of the incoming packet
Horizon Compact generates a packet (e.g. SNMP Trap, or software download request to FTP server)	There is no VLAN tag inserted.
FTP Server, SNMP Manager, SNMP Trap Hosts are NOT on a VLAN	Servers are reachable by Horizon Compact
FTP Server, SNMP Manager, SNMP Trap Hosts are on a VLAN	Servers are NOT reachable by Horizon Compact since Horizon Compact does not insert a VLAN tag into the packet.

Table 3-2
VLAN Configuration: Network Protocol Strict is OFF. VLAN tagging is ON, VLAN tag has been programmed into Horizon Compact

Horizon Compact management is set to "friendly" mode due to network protocol strict being set to OFF. In this configuration Horizon Compact will only generate and respond to VLAN packets.

Condition	Horizon Compact Outgoing Packet
Horizon Compact incoming packet does NOT contain a VLAN tag	Horizon Compact responds to the packet. There is no VLAN tag inserted.
Horizon Compact incoming packet contains a VLAN tag	Horizon Compact inserts VLAN tag in the response in order to match the VLAN tag of the incoming packet.
Horizon Compact generates a packet (e.g. SNMP Trap, or software download request to FTP server)	Horizon Compact inserts the programmed VLAN tag in the response
FTP Server, SNMP Manager, SNMP Trap Hosts are NOT on a VLAN	Servers are NOT reachable by Horizon Compact since Horizon Compact inserts a VLAN tag into the packet and the target is not programmed for VLAN.
FTP Server, SNMP Manager, SNMP Trap Hosts are on the same VLAN as Horizon Compact	Servers are reachable by Horizon Compact

Table 3-3
VLAN Configuration Network Protocol Strict is ON. VLAN tagging is OFF

Horizon Compact management is set to "strict" mode due to network protocol strict being set to ON. In this configuration VLAN tagging is OFF, therefore no Horizon Compact packets contain VLAN tags.

Condition	Horizon Compact Outgoing Packet
Horizon Compact incoming packet does NOT contain a VLAN tag	Horizon Compact responds to the packet. There is no VLAN tag inserted.
Horizon Compact incoming packet contains a VLAN tag	Horizon Compact does not respond to the incoming packet. Horizon Compact will not respond to packets that have a VLAN tag.
Horizon Compact generates a packet (e.g. SNMP Trap)	There is no VLAN tag inserted.
FTP Server, SNMP Manager, SNMP Trap Hosts are NOT on a VLAN	Servers are reachable by Horizon Compact.
FTP Server, SNMP Manager, SNMP Trap Hosts are on the same VLAN as Horizon Compact	Servers are NOT reachable by Horizon Compact since Horizon Compact does not insert a VLAN tag into the packet.

Table 3-4
VLAN Configuration Network Protocol Strict is ON. VLAN tagging is ON.

Horizon Compact management is set to "strict" mode due to network protocol strict being set to ON. In this configuration VLAN tagging is ON, therefore ALL Horizon Compact packets must contain VLAN tags.

Condition	Horizon Compact Outgoing Packet
Horizon Compact incoming packet does NOT contain a VLAN tag	Horizon Compact does not respond to the packet. Horizon Compact will only respond to packets that contain the appropriate VLAN tag.
Horizon Compact incoming packet contains a VLAN tag	Horizon Compact responds to the packet if the VLAN tag matches the Horizon Compact programmed VLAN tag.
Horizon Compact generates a packet (e.g. SNMP Trap)	Horizon Compact inserts the programmed VLAN tag in the response.
FTP Server, SNMP Manager, SNMP Trap Hosts are NOT on a VLAN	Servers are NOT reachable by Horizon Compact. Horizon Compact does not insert a VLAN tag into the packet but the target has been programmed for VLAN.
FTP Server, SNMP Manager, SNMP Trap Hosts are on the same VLAN as Horizon Compact	Servers are reachable by Horizon Compact since they have the matching VLAN tag.

Procedure 3-2
Enable VLAN tagging

Perform this procedure to enable VLAN tagging for the Horizon Compact.

Note: To perform this procedure, you must have NOC user rights.

Required Action	Steps
login	Log in as a NOC user.
get vlan tagging	Displays the VLAN tagging operational state for the system. Sequence: **get vlan tagging** press Enter The system responds: *VLAN tagging: [off | on]*
set vlan tagging [on|off]	Sets the VLAN tagging operational state for the system. Sequence: **set vlan tagging [off | on]** press Enter The system responds: *VLAN tagging: [off |on]*
set vlan tag [XXXX]	Enables or disables the VLAN tagging operational state you set when you executed the set vlan tagging command. VLAN tagging follows the 802.1Q standard. **Note:** If you set the VLAN tag to the incorrect value, you can lose remote access to the Horizon Compact. Make sure the VLAN tag matches your administrative network tag. Sequence: **set vlan tag [XXXX]** [Y]press Enter where **[XXXX]** is the two–byte tag control [Y] is the priority bit for 802.1P and is in the range of 0-7. The system responds: *VLAN tag: [XXXX Y]*

Required Action	Steps
get vlan tag	Displays that the VLAN tagging information for the system. VLAN tagging is enabled when a valid VLAN tag has been entered using the set vlan tag command. **Note:** If you have entered an incorrect VLAN tag, you cannot communicate remotely with the Horizon Compact. Sequence: **get vlan tag** press Enter The system responds: *VLAN ID :[XXXX]* *VLAN Priority is [Y]*
save mib	Saves the MIB to RAM. Perform this command to save setting changes to non-volatile memory. Sequence: **save mib** press Enter The system responds: *MIB saved successfully.*
Reset system	A system reset is required to activate this feature. Sequence **reset system** press Enter The system responds: *Are you sure you want to reset? Y(yes) or N(no)* press **Y** The system will proceed to reset. You will have to log on again to regain access.

This concludes the steps to enable VLAN tagging for the Horizon Compact system using the CLI manager.

3.3 CoS / QoS 802.1P Priority Tagging

QoS implementation is best done on the ingress and egress portions of the transport network. As such, QoS should be implemented on the Ethernet switches. Once that implementation is in place, the Horizon Compact can be configured for QoS, should the potential for congestion exist. Enabling CoS/QoS (802.1P) on Horizon Compact ensures that the high priority traffic is delivered at the expense of lower priority traffic.

Horizon Compact supports the eight Classes of Service (CoS) levels (0-7) defined within 802.1P. There are four CoS Queues within Horizon Compact, numbered 1 to 4. Any of the eight CoS levels can be assigned to any of the four Horizon Compact CoS Queues. Horizon can also be configured to use the priority bits found in the DSCP field of IP headers. Any frames not having an IP header can be classified based on the default class of service value (**set cos default value [0 though 7]**).

In Horizon any, or all, of the four CoS Queues can be configured as expedite queues.

A typical CoS assignment is shown in Figure 3-1

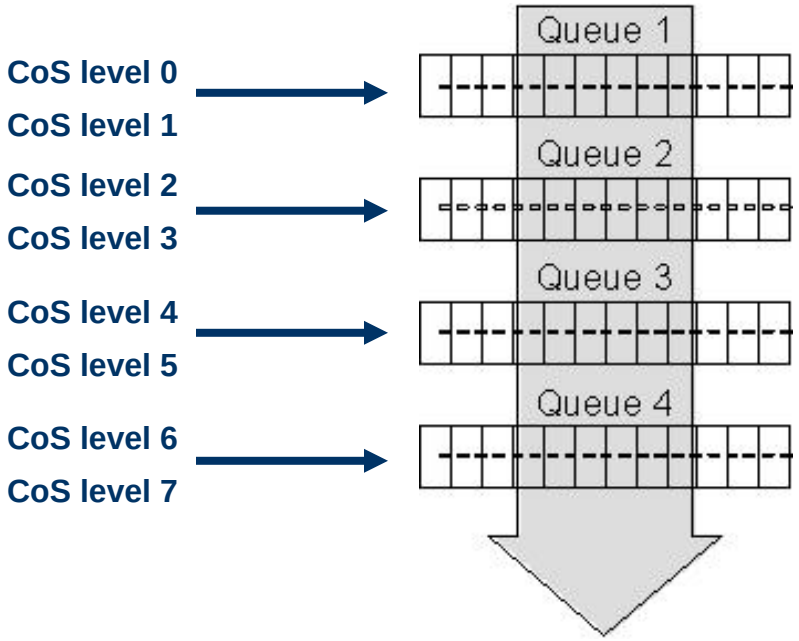


Figure 3-1 802.1P Enabled on Horizon Compact with Example CoS Allocations

There are three additional Horizon Compact settings that can be used to customize the data flow to match network requirements:

1. CoS Committed Information Rate (CIR), which determines the guaranteed bandwidth allocated to a particular Queue.
2. CoS Committed Burst Size, which determines the amount of burst data the Queue can manage.
3. Expedite Queuing (see Section 3.3.4), which allows a Queue to be set as a priority Queue whereby it delivers its data at the expense of other non-Expedite Queues.

A representative drawing of the QoS components and functional blocks is shown in Figure 3-2. Note that Queue 4 is shown as being configured as an expedite queue (recommended if only one expedite queue is desired). Any, or all, of the four queues can be configured as expedite queues.

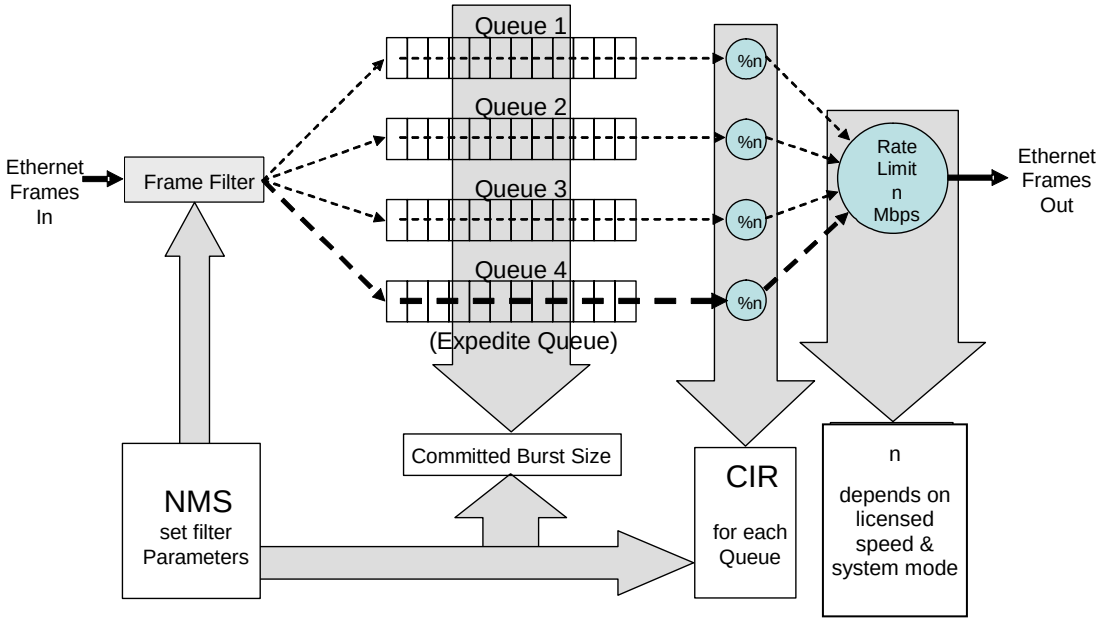


Figure 3-2 CoS Queues can be allocated a CIR and a Committed Burst Size.

3.3.1 Class of Service Types

Horizon Compact has the flexibility to manage the priority requirements of Super VLAN or Q-in-Q framing as well as standard VLAN frames. Horizon Compact can be configured to manage standard VLAN frames, or Q-in-Q frames.

For Q-in-Q frames, since a standard VLAN frame is encapsulated within the Q-in-Q frame, there may be two priority levels associated with the Q-in-Q frame. One will be the priority of the encapsulated, or inner, VLAN frame and the other will be the priority of the Q-in-Q, or outer, frame. The Horizon Compact class of service type can be configured to look at the priority levels of either, the inner, or outer, frames and direct frames to the appropriate Horizon Compact queue.

3.3.2 CoS Committed Information Rate (CIR)

The Horizon Compact system allows the user to assign a percentage of the maximum bandwidth available to the data flowing in each of the four QoS Queues. Its purpose is to ensure that each Queue gets at least a portion of the bandwidth and does not get "starved" of bandwidth resulting in no bandwidth being allocated. If CIR was not available:

- QUEUE 4 would get most of its packets through
- QUEUE 3 would get a large percentage of its packets through
- QUEUE 2 would get some of its packets through
- QUEUE 1 would get very few of its packets through
- The "Scheduler" algorithm then progresses as follows:
    - QUEUE 4,
    - back to QUEUE 4 then to QUEUE 3,
    - QUEUE 4 then QUEUE 3 then QUEUE 2,
    - QUEUE 4 then QUEUE 3 then QUEUE 2 then QUEUE 1

The scheduler uses it's algorithm to search for and deliver traffic in each of the Queues, but it also checks that the CIR rate has been met, and has not been exceeded**.** If the CIR rate has reached its maximum, then the scheduler moves on to the next Queue according to its algorithm. For example:

- The Scheduler checks QUEUE 4 for packets.
- If there is a packet AND the CIR threshold has not been met, then service the Queue.
- If the CIR threshold has been exceeded, then jump to QUEUE 3 without processing the packet (in order to ensure that QUEUE 3 is allocated its CIR bandwidth)

Each Queue can have different maximum bandwidths or information rates assigned to them but the total CIR cannot exceed 100%. For example:

- Assuming a 200 Mbps system:
- With Queue 1 assigned a CIR of **10% (20Mbps)** or **25% (50Mbps)**
- With Queue 2 assigned a CIR of **20% (40Mbps)** or **25% (50Mbps)**
- With Queue 2 assigned a CIR of **30% (60Mbps)** or **25% (50Mbps)**
- With Queue 2 assigned a CIR of **40% (80Mbps)** or **25% (50Mbps)**

=100%(200Mbps) 100%(200Mbps)

NOTE: See also section 3.3.4 Expedite Queuing

3.3.3 CoS Queue Committed Burst Size

Since IP traffic is "bursty" in nature, the Horizon Compact provides a feature, called CoS Queue Committed Burst Size (CBS) to handle Ethernet bursts. The Horizon Compact system contains a data buffer that is used to accommodate bursts of traffic in excess of the user allocated amount as specified through the CIR setting for each Queue. The buffer is used for traffic bursts only and is functional when 802.1P is enabled on the Horizon Compact system.

The CoS Queue CBS defines the percentage of the total amount of burst buffer that the Queue is allocated. There is a total of 100 Mbits of buffer allocated to CoS Queues. Each Queue can be allocated a percentage of this memory. The default allocation for all four Queues is 25%. Each Queue can be allocated a percentage of the total memory space available for CoS Queues and the total percentage equals 100%. The CoS Queue CBS function will "smooth out" the output and transmit at the Queue's CIR by flushing the burst buffer allocation.

The CoS Queue CBS operates as a FIFO for each individual queue. Burst traffic will be handled as an extension of the CIR and therefore will be inserted, or interjected, into the Queue as it arrives. This may have the effect of creating a short delay for subsequent traffic arriving at that Queue if the subsequent traffic is at that Queue's CIR level. Conversely, if the burst is followed by traffic that is less than the CIR

level, then no delay should occur. This technique prevents out of order packets over the Horizon Compact system.

For example: QUEUE 3 has 25% CIR or 25 Mbps on a 100 Mbps link. The CoS Queue CBS is set to 25% or 25 Mbits. If Queue 3 receives a burst of traffic in excess of 25 Mbps then QUEUE 3 would continue to transmit at 25 Mbps until the 25 Mbit "burst buffer" is empty, regardless of whether or not the the traffic source is sending packets. If the traffic source continues to send packets then the original 25 Mbps is transmitted, followed by the "burst buffer" traffic, followed by new incoming packets.

3.3.4 Expedite Queuing

Expedite Queuing is a mechanism that allows one or more of the 4 Queues to transmit its data as priority traffic, at the expense of the remaining Queues. When Expedite Queue feature is enabled, then as long as there is data in the Expedite Queue, or Queues, that data will be transmitted first. This allows time critical, or error-sensitive, traffic to have priority data delivery.

The Horizon Compact system allows the user to configure one or more Queues as "expedite" Queues. Any or all of the 4 Queues can be made into Expedite Queues. This allows custom configurations such as QUEUE 4 = Voice, QUEUE 3 = Video over IP, QUEUE 2 = database transfers, QUEUE 1 = Internet email, Web, etc. The Scheduler continues to service QUEUE 4 through QUEUE 1 in order, however when a Queue is set as an Expedite Queue it will service the Expedite Queue first and continue to service it until it is empty. After the Expedite Queue has been flushed of data, the Scheduler will continue to service the other Queues according to its main algorithm.

To configure a Queue to be an Expedite Queue (once the "set Expedite Queue on" command has been issued") assign the CIR for that Queue to 100%. Each of the 4 Queues can be assigned a CIR of 100%. The total CIR can now be greater than 100%, up to a maximum of 400% (4 Queues). A total CIR of 400% means ALL 4 Queues are Expedite Queues and each one can use 100% of the bandwidth. ***It does not mean the Horizon Compact system can achieve 400% of the Horizon Compact maximum bandwidth, simply that if any bandwidth is available after a previous Queue has been serviced, the next Queue in line will be given full access to the remaining bandwidth until fully serviced.*** IF Expedite Queuing is turned OFF, then the total CIR cannot exceed 100%.

As network services increase, the need for multiple Expedite Queues becomes evident. A network administrator may require 3 Expedite Queues and decide to send all network routing protocols through the highest Expedite Queue, send IP Voice through the next highest Expedite Queue, send Video over IP through the next highest Expedite Queue. Send all other traffic to the remaining Queue, which is not configured as an Expedite Queue. To do this, the administrator would configure Queues 4,3 and 2 as Expedite Queues and configure Queue 1 as a standard Queue with a particular CIR.

3.3.5 Operation of QoS using multiple Expedite Queues

When multiple Expedite Queues are enabled, the Scheduler will continue to follow in the same sequence/rules as the previous release.

The sequence is:

- Service QUEUE 4
- Recheck QUEUE 4 and if empty, service QUEUE 3
- Recheck QUEUE 4 and if empty, check QUEUE 3 and if empty, service QUEUE 2
- Recheck QUEUE 4 and if empty, check QUEUE 3 and if empty, check QUEUE 2 and if empty, service QUEUE 1

Each Queue having 100% CIR (priority) will be serviced until empty, then the Scheduler moves on to the next priority Queue. The effect of setting a Queue as an Expedite Queue is to override the Scheduler's sequence and force it to service the Expedite Queue first and continue to service it until empty. Any Queue can be configured as an Expedite Queue and therefore override the Scheduler's sequence. For example: if Queue 1 is set as the only Expedite Queue then QUEUE 1 will be serviced first, followed by Queue 4 then Queue 3 then Queue 2. At any time, should data arrive in Queue 1, then the Scheduler will "jump" to Queue 1 in order to service it.

Example 1: Queues configured with the following settings :

- QUEUE 4 = 100%
- QUEUE 3 = 100%
- QUEUE 2 = 75%
- QUEUE 1 = 25%
- In this example, voice traffic could be assigned to QUEUE 4, IPTV could be assigned to QUEUE 3, Database transfers assigned to QUEUE 2, and Internet traffic assigned to QUEUE 1
- QUEUE 4 is serviced as a priority Queue until empty
- QUEUE 3 is serviced as a priority Queue until empty or until QUEUE 4 receives packet
- If neither QUEUE 4 or QUEUE 3 have packets, service QUEUE 2 until empty or CIR limit is met, or until QUEUE 4 or QUEUE 3 packets arrive
- Service QUEUE 1 when no other packets exist in QUEUE 4, QUEUE 3, QUEUE 2 and QUEUE 1 CIR limit has not been met

Example 2: Assuming that the total bandwidth available is 200Mbps, if the Expedite Queue is "ON" and the CIR for the remaining Queues are set to:

- QUEUE 4 = 100%
- QUEUE 3 = 100%
- QUEUE 2 = 0%
- QUEUE 1 = 0%

In this scenario, with Expedite Queue "on" and QUEUE 4 set to 100%, QUEUE 4 will be given priority access to the full bandwidth available on the link.

Once QUEUE 4's throughput requirements have been satisfied, 100% of any remaining bandwidth will be given to QUEUE 3.

Will allow the user to set the system up with a "prioritized Expedite Queue" configuration, whereby QUEUE 4 gets full bandwidth until satisfied, and then QUEUE 3 gets100% of what is left over. (useful in applications where 2 types of "high priority traffic" need to be serviced)

Note that in this example untagged traffic or traffic assigned to Queues 1 or 2 will not be transmitted due to QUEUE 1 being set to 0% CIR.

Example 3: Assuming that the total bandwidth available is 200Mbps, if the Expedite Queue is "ON" and the CIR for the remaining Queues are set to:

- QUEUE 4 = 100%
- QUEUE 3 = 50%
- QUEUE 2 = 50%
- QUEUE 1 = 100%

In this scenario, with Expedite Queue "on", and QUEUE 4/QUEUE 1 set to 100%, QUEUE 4 will be given priority access to the full bandwidth available on the link (200Mbps). When its traffic commitments have been met, QUEUE 1 will then be given the remaining available bandwidth to service its incoming traffic. Once QUEUE 4 and QUEUE 1's requirements have been met, QUEUE 3 will be serviced by the scheduler up to but not beyond its CIR limit (should any bandwidth be available). Once QUEUE 4, QUEUE 1 and QUEUE 3 have been serviced, QUEUE 2 will receive any remaining bandwidth to service its incoming traffic.

Example: QUEUE 4 and QUEUE 1 each have 70Mbps of traffic to service (140Mbps). The scheduler first handles QUEUE 4's requirements, then QUEUE 1's, which leaves 60Mbps of bandwidth available for QUEUE 3 and QUEUE 2. If QUEUE 3 and QUEUE 2 both have 50Mbps of incoming traffic, the scheduler will service QUEUE 3 first, up to but not beyond its CIR limit of 50Mbps. The remaining 10Mbps will be dedicated to QUEUE 2 as long as no packets arrive in QUEUE 4 or QUEUE 1.

3.3.6 Operation with 802.1P Priority Queuing Disabled

If 802.1P filtering is disabled in the Horizon Compact system, all incoming packets are treated equally and are forwarded on a first-come first-served basis. The system operates in a FIFO (First In First Out) basis.

If the Pause Frames feature (see Section 3.4) is enabled, pause frames will be sent to the connected switch when the input buffer is close to being full (internally set threshold). This allows time for the queue to empty prior to more frames being received and thus avoids congestion.

3.3.7 Operation with 802.1P Priority Queuing Enabled

If 802.1P filtering is enabled in the Horizon Compact system, the scheduling mechanism can be described as follows:

1. Select the highest priority queue which has a packet in it
2. Send that packet

If COS CIRs are set for the queues, then the scheduling mechanism can be described as follows:

1. Select the highest priority queue which has a packet in it, and hasn't used up its CIR budget
2. Send that packet

The operation of the Scheduler is affected by both the user-configurable CIR and CoS Queue CBS settings.

If the Pause Frames feature (see Section 3.4) is enabled, pause frames will be sent to the connected switch when the input buffer is close to being full (internally set threshold).

The Horizon Compact system also allows any packets without a VLAN tag to be allocated an 802.1P CoS level ("set untagged packet priority"). If the "set untagged packet priority" is not configured, then all untagged packets will be forwarded through Queue 1.

Horizon Compact is also able to manage Q-in-Q or Super VLAN traffic. The system can be configured to use either an encapsulated frame's priority tag or the encapsulating frame's priority tag, in determining priority handling.

3.3.8 Management Traffic

Slow Ethernet services and multicast packets are handled by a special Queue inside the Horizon Compact. The Queue is not user-accessible. It works similar to an Expedite Queue in that it ensures management traffic is passed through in an "expedited" fashion. It does not affect, nor is related to the four Queues within Horizon Compact.

Packets destined for the **01-80-C2-00-00-xx** MAC addresses are sent to the internal Queue. Examples: STP, RSTP, MSTP LACP, Pause Frames, GARP (GMRP,GVRP), bridge broadcasts, OAM, LLDP, Port based authentication are all sent to the internal Queue and are transmitted in an expedited fashion. Other packets that the user determines must be treated in an expedited fashion, such as "keep-alive" packets and MRP packets, must be assigned a CoS within the switch, then assigned to the appropriate Queue within Horizon Compact.

Procedure 3-3
Enable 802.1P Priority Queuing

Perform this procedure to enable 802.1P Priority Queuing for the Horizon Compact.

Note: To perform this procedure, you must have NOC user rights.

Required Action	Steps
login	Log in as a NOC user.
set qos [on/off]	Enables or disables (on or off) quality of service (QoS) on the Horizon Compact system. QoS is part of the 802.1P specification. Sequence: **set qos [on/off]** press Enter where **on** will enable QoS and **off** will disable QoS The system responds: *qos is : [on/off]*
set cos type	Sets the CoS system to handle VLAN or Q-in-Q frame formats. Sequence: **set cos type [cos_vlan/cos_qinq_itag/cos_qinq_otag/cos_dscp]** press Enter The system responds: *CoS type is set to : cos_vlan/cos_qinq_itag/cos_qinq_otag/cos_dscp* Note: cos_vlan uses the priority tag of standard VLAN frames cos_qinq_itag uses the inner priority tag of a Q-in-Q frame cos_qinq_otag uses the outer priority tag of a Q-in-Q frame cos_dscp uses the 3 bit priority information in the DSCP field of the IP header (also referred to as ToS).

Required Action	Steps
set cos queue mapping [x x x x x x x x]	Assigns each of the incoming 802.1P CoS levels to either of the four Horizon Compact CoS Queues. The Horizon Compact system supports all eight 802.1P CoS levels (0-7). Sequence: **set cos queue mapping [x x x x x x x x]** press Enter where each **x** is a value of either 1, 2, 3 or 4 representing the Horizon Compact CoS Queues allocated to each of the 801.1P CoS levels (0-7) in order. Any values not explicitly assigned by the user will not be affected by the command. The system responds: *dot1p Queue assignment is as follows :* *dot1p value CoSQueue* *---------- -- ---------* *0 [x]* *1 [x]* *2 [x]* *3 [x]* *4 [x]* *5 [x]* *6 [x]* *7 [x]* *Where [x] is a value of either 1, 2, 3 or 4* *Examples:* **set cos queue mapping [1 1 2 2 3 3 3 4]** press Enter will allocate 802.1P CoS levels 0-1 to Horizon Compact CoS Queue 1, CoS levels 2-3 to Horizon Compact CoS Queue 2 CoS levels 4-6. to Horizon Compact CoS Queue 3 and CoS level 7 to Horizon Compact CoS Queue 4. Note that there is a space between each of the digits in the command. The system responds: *cos queue assignment is as follows :* *dot1p value CoSQueue* *---------- -- ---------* *0 1* *1 1* *2 2* *3 2* *4 3* *5 3* *6 3* *7 4*

Required Action	Steps
set cos expedite queue	Enables or disables the expedite queue function. Expedite queues are processed first, prior to any other queue being processed. This allows the user to force the system to transmit high priority traffic before lower priority traffic. Sequence: **set cos expedite queue [on/off]** The system responds: *Expedite queue is :on/off*
set cos queue cir [%**1** %**2** %**3** %**4**]	Sets the Committed Information Rate (CIR) for each of the 4 CoS Queues. The CIR defines the minimum amount of bandwidth allocated for that Queue. Note that Queues set as Expedite Queues can override the CIR for other Queues should congestion occur. Sequence: **set cos queue cir [%1 %2 %3 %4]** press Enter where **%1 %2 %3 %4** is the percentage of the total Queue memory to be allocated to CoS Queues 1 through 4 respectively. The total cannot exceed 100% unless Expedite Queuing has been enabled. The system responds: (example shown using 25% settings for each queue) *Expedite queue is :off.* *All queues bandwidth are guaranteed.* *Queue CIR(%) CIR(Mbps)* *1 25 25* *2 25 25* *3 25 25* *4 25 25* If Expedite Queuing has been enabled, then each queue that has been configured for 100% CIR is treated as an Expedite Queue. Sequence: **set cos queue cir 25 100 25 100** The system responds: *Expedite queue is :on* *Bandwidth for higher priority queues are guaranteed over lower priority queues* *Queue CIR(%) CIR(Mbps)* *1 25 25* *2 100 Full* *3 25 25* *4 100 Full* "Full" indicates that the queue is an Expedite Queue and can consume the full bandwidth of the Horizon Compact.

Required Action	Steps
set cos queue cbs [%**1** %**2** %**3** %**4**]	Sets the committed burst size for each of the four Class of Service (CoS) Queues, as a percentage of the total Queue memory available. There is a total of 100 msec worth of memory space allocated to CoS Queues. A percentage of this space is allocated to each of the four Queues. Sequence: **set cos queue cbs [%1 %2 %3 %4]** press Enter where **%1 %2 %3 %4** is the percentage of the total Queue memory to be allocated to CoS Queues 1 through 4 respectively. Note that the total of all Queues must not exceed 100% The system responds: *Queue* *Size (%)* *1* *%1* *2* *%2* *3* *%3* *4* *%4* *Example:* **get cos queue cbs** press Enter The system responds: *Queue* *Size (%)* *1* *25* *2* *25* *3* *25* *4* *25* **set cos queue cbs 10 20 30 40** press Enter The system responds: *Queue* *Size (%)* *1* *10* *2* *20* *3* *30* *4* *40*

Required Action	Steps
set cos default value	Assigns packets that do not have CoS levels (not complying with 802.1P) to any one of the eight 802.1P CoS levels (0-7). Sequence: **set cos default value [n]** press Enter where “n” is any number 0 through 7. The system responds: *Packets without VLAN tag are treated as 802.1p priority: n*
save mib	Saves the MIB to RAM. Perform this command to save setting changes to non-volatile memory. Sequence: **save mib** press Enter The system responds: *MIB saved successfully.*
Reset system	A system reset is required to activate this feature. Sequence **reset system** press Enter The system responds: *Are you sure you want to reset? Y(yes) or N(no)* press **Y** The system will proceed to reset. You will have to log on again to regain access.

This concludes the steps to configure 802.1P Priority Queuing using the CLI manager.

3.4 Pause Frames

Pause frames are generated by the weaker (slower) link when its forward pipe gets full. Pause frames inform the upstream device to “pause and stop sending traffic for a period of 5 msec”. When the Pause Frame feature is enabled, Horizon Compact generates pause frames to the Ethernet switch when the Horizon Compact receiving buffer hits the internally set threshold. The receiving buffer threshold is close to 100 msec at GigE rate. At data rates lower than GigE, the data buffer will accommodate a lesser amount of data. The Pause Frame feature can be used when CoS/QoS is enabled or disabled.

Procedure 3-4
Configuring the Pause Frames feature

Perform this procedure to enable or disable pause frames for the Horizon Compact.

Note: To perform this procedure, you must have NOC user rights.

Required Action	Steps
login	Log in as a NOC user.
get pause state	Returns the current state of the pause frame feature. Sequence: **get pause state** press Enter The system responds: *Asymmetric PAUSE is on/off.*
set pause state	Enables or disables the pause frame feature. Sequence: **set pause state [on/off]** press Enter The system responds: *This may affect user traffic. Continue? Enter Y(Yes) or N(No):**Y*** *Asymmetric PAUSE is : on, PAUSE frames can flow towards the link partner.*
save mib	Saves the MIB to RAM. Perform this command to save setting changes to non-volatile memory. Sequence: **save mib** press Enter The system responds: *MIB saved successfully.*

3.5 Horizon Compact Throughput Speed

When you purchase a Horizon Compact system you receive a unit capable of giving a throughput speed of up to 400 Mbps. However, the actual throughput speed achievable for any given system depends on the specific licensed speed key that you purchased with the system

You can upgrade your system to a higher licensed speed by purchasing an upgrade key and reprogramming your system. Any upgraded system can be reconfigured to a lower system speed (CLI command **set system speed**) as required, without losing the ability to return to the upgraded licensed speed.

You may also downgrade the licensed speed to a lower value. A downgraded system may warrant a refund of licensing fees. Once downgraded, new upgrade keys will be required for future upgrading.

System speeds do not have to be symmetrical (same speed in both directions on the link). Asymmetric speeds (different speeds in each direction) can also be configured.

3.5.1 Maximum Throughput Speed

The maximum throughput speed is determined by the Horizon Compact licensed speed key you purchase, however, it is important to note that the maximum speed is also determined by the Channel bandwidth associated with the configured radio band, and the modulation scheme used. The channel bandwidth is a function of the radio band and the modulation scheme is selected depending on the desired maximum throughput. Configuring the Radio Band and System Mode determines the maximum throughput capability and the modulation scheme applied.

Note that if a System Mode is set with a maximum throughput capability that exceeds the licensed speed key purchased from DragonWave, then the maximum speed attainable will be limited to the licensed speed purchased. By default the system speed is set to the licensed speed key purchased, however, it can be reduced to a lower level without losing the ability to return to the purchased licensed speed.

(combination of channel bandwidth and maximum throughput).

Table 3-5 System Mode and Modulation Scheme

Modulation scheme	Channel Bandwidth 50 MHz			Channel Bandwidth 40 MHz			Channel Bandwidth 30 MHz		
	Throughput Mbps	TX Power dB	RX Sensitivity dB	Throughput Mbps	TX Power dB	RX Sensitivity dB	Throughput Mbps	TX Power dB	RX Sensitivity dB
QPSK	67	17/27	-81	58	17/27	-81			
16 QAM	110	14.5/24.5	-78	110	14.5/24.5	-75			
32 QAM	171	14/24	-73	143	14.5/24.5	-74	107	14.5/24.5	-75
64 QAM	215	12.5/22.5	-69	181	12.5/22.5	-70	128	12.522.5	-72
128 QAM	271	11/21	-66	212	11/21	-67	165	11/21	-68
256 QAM	322	11.5/21.5	-60						
256 QAM	371	9.5/19.5	-60	277	9.5/19.5	-61	212	9.5/19.5	-62
Modulation scheme	**Channel Bandwidth 56/55 MHz**			**Channel Bandwidth 28 MHz**			**Channel Bandwidth 14 MHz**		
	Throughput Mbps	**TX Power dB**	**RX Sensitivity dB**	**Throughput Mbps**	**TX Power dB**	**RX Sensitivity dB**	**Throughput Mbps**	**TX Power dB**	**RX Sensitivity dB**
QPSK				37	17/27	-83			
QPSK	65	17/27	-80	48	13.5/23.5	-82	23	13.5/23.5	-85
16 QAM	111	14.5/24.5	-77	71	13/23	-79	36	13/23	-82
32 QAM	216	11/21	-72	100	11/21	-75	47	13/23	-78
128 QAM	290	10.5/20.5	-66	144	10.5/20.5	-69	70	10.5/20.5	-72
256 QAM	385	9.5/19.5	-60	190	9.5/19.5	-63	95	9.5/19.5	-66

shows the modulation schemes that are selected for various System Modes (combination of channel bandwidth and maximum throughput).

Table 3-5 System Mode and Modulation Scheme

Modulation scheme	Channel Bandwidth 50 MHz			Channel Bandwidth 40 MHz			Channel Bandwidth 30 MHz		
	Throughput Mbps	TX Power dB	RX Sensitivity dB	Throughput Mbps	TX Power dB	RX Sensitivity dB	Throughput Mbps	TX Power dB	RX Sensitivity dB
QPSK	67	17/27	-81	58	17/27	-81			
16 QAM	110	14.5/24.5	-78	110	14.5/24.5	-75			
32 QAM	171	14/24	-73	143	14.5/24.5	-74	107	14.5/24.5	-75
64 QAM	215	12.5/22.5	-69	181	12.5/22.5	-70	128	12.522.5	-72
128 QAM	271	11/21	-66	212	11/21	-67	165	11/21	-68
256 QAM	322	11.5/21.5	-60						
256 QAM	371	9.5/19.5	-60	277	9.5/19.5	-61	212	9.5/19.5	-62
Modulation scheme	**Channel Bandwidth 56/55 MHz**			**Channel Bandwidth 28 MHz**			**Channel Bandwidth 14 MHz**		
	Throughput Mbps	**TX Power dB**	**RX Sensitivity dB**	**Throughput Mbps**	**TX Power dB**	**RX Sensitivity dB**	**Throughput Mbps**	**TX Power dB**	**RX Sensitivity dB**
QPSK				37	17/27	-83			
QPSK	65	17/27	-80	48	13.5/23.5	-82	23	13.5/23.5	-85
16 QAM	111	14.5/24.5	-77	71	13/23	-79	36	13/23	-82
32 QAM	216	11/21	-72	100	11/21	-75	47	13/23	-78
128 QAM	290	10.5/20.5	-66	144	10.5/20.5	-69	70	10.5/20.5	-72
256 QAM	385	9.5/19.5	-60	190	9.5/19.5	-63	95	9.5/19.5	-66

Procedure 3-5
Configure Horizon Compact Throughput Speed (Symmetrical Throughput)

Required Action	Steps
login	Log in as a NOC user.
get system speed	Returns the licensed speed key value, the current set system speed and the set mode. Sequence: **get system speed** press Enter The system responds: *Licensed speed set to : n Mbps* *Current speed set to : n Mbps* *System mode set to : <system mode>* Example: Licensed speed set to :50 Mbps Current speed set to :50 Mbps System mode set to :hc50_67_qpsk Note that although the mode shows a speed of 67 Mbps, the actual speed will be limited to the current speed, or the licensed speed, whichever is the lower.

Required Action	Steps
get system mode	Returns the current system mode and a list of available system modes. Sequence: **get system mode** press Enter System responds: *Current system mode is :hc50_67_qpsk* (Example) *System modes available in the system:* *cw_test* *hc50_67_qpsk* *hc50_110_16qam* *hc50_171_32qam* *hc50_215_64qam* *hc50_271_128qam* *hc50_322_256qam* *hc50_371_256qam*
set system mode	Sets the system mode (channel bandwidth, maximum throughput speed and modulation scheme). You can only select any one of the modes shown as available when the **get system mode** command is used. Sequence: **set system mode <hc[bandwidth]_[throughput]_[modulation]>** Where **[bandwidth]** is the channel bandwidth of the configured radio band; **[throughput]** is the maximum throughput capability in Mbps; **[modulation]** is the modulation scheme. Example: **set system mode hc50_67_qpsk** press Enter (50 MHz channel bandwidth, 67 Mbps throughput and QPSK modulation. System responds: *System mode set to :hc50_67_qpsk*
save mib	Saves the MIB to RAM. Perform this command to save setting changes to non-volatile memory. Sequence: **save mib** press Enter The system responds: *MIB saved successfully.*

Required Action	Steps
Reset system	A system reset is required to activate this feature. Sequence **reset system** press Enter The system responds: *Are you sure you want to reset? Y(yes) or N(no)* press **Y** The system will proceed to reset. You will have to log on again to regain access.

3.5.2 Asymmetric Throughput Speed

Asymmetric throughput can be achieved by installing the same Horizon Compact hardware type at each end of the link, and configuring one end with a different system speed. Note, that the System Mode, must be identical at each end of the link for this to work. The variable will be the system speed figure.

Procedure 3-6
Configure Horizon Compact Throughput Speed (Asymmetric)

Required Action	Steps
login	Log in as a NOC user.
get system mode	Returns the current system mode and a list of available system modes. Sequence: **get system mode** press Enter System responds: *Current system mode is :hc50_67_qpsk* (Example) *System modes available in the system:* *cw_test* *hc50_67_qpsk* *hc50_110_16qam* *hc50_171_32qam* *hc50_215_64qam* *hc50_271_128qam* *hc50_322_256qam* *hc50_371_256qam*
set system mode	Sets the system mode (channel bandwidth, maximum throughput speed and modulation scheme). Sequence: **set system mode <hc[bandwidth]_[throughput]_[modulation]>** Example: **set system mode hc50_110_16qam** press Enter (50 MHz channel bandwidth, 110 Mbps throughput and 16QAM modulation. System responds: *System mode set to :hc50_110_16qam* Note: For asymmetric speeds, the system mode must be set identically at each end of the link.

Required Action	Steps
Set system speed	Sets the system speed. (Cannot exceed the speed key purchased with your system). Sequence: **set system current speed 50** press Enter System responds: *System speed set to 50 Mbps* Note**:** For asymmetric speeds the speed at the other end of the link would be set to a different value. Example: Near end – **set system current speed 50** press Enter Far end – **set system current speed 100** press Enter Note: if the speed at one end was to be the purchased speed (default), then this command would not need to be invoked at that end.
save mib	Saves the MIB to RAM. Perform this command to save setting changes to non-volatile memory. Sequence: **save mib** press Enter The system responds: *MIB saved successfully.*
Reset system	A system reset is required to activate this feature. Sequence **reset system** press Enter The system responds: *Are you sure you want to reset? Y(yes) or N(no)* press **Y** The system will proceed to reset. You will have to log on again to regain access.

3.5.3 Upgrading System License Speed

Upgrading the system licensed speed requires an upgrade license key obtainable from DragonWave. Upgrading the licensed speed does not cause you to lose the ability to reduce the speed and then return to the new licensed speed at a later time.

Note that the licensed speed is the maximum speed that the system can operate at, regardless of the setting of the System Mode.

Procedure 3-7
Upgrading Horizon Compact System License Speed

Required Action	Steps
login	Log in as a NOC user.
get system speed	Returns the licensed speed key value, the current set system speed and the set mode. Sequence: **get system speed** press Enter The system responds: *Licensed speed set to : n Mbps* *Current speed set to : n Mbps* *System mode set to : <system mode>* Example: Licensed speed set to :50 Mbps Current speed set to :50 Mbps System mode set to :hc50_67_qpsk Note that although the mode shows a speed of 67 Mbps, the actual speed will be limited to the current speed, or the licensed speed, whichever is the lower.
Upgrade system licensed speed	Upgrades the system to operate at a higher speed. A license key is required for this command. Contact DragonWave. Sequence: **upgrade system licensed speed [speed] [key]** press Enter Where **[speed]** is the new licensed speed, and **[key]** is the license key obtained from DragonWave

Required Action	Steps
save mib	Saves the MIB to RAM. Perform this command to save setting changes to non-volatile memory. Sequence: **save mib** press Enter The system responds: *MIB saved successfully.*
Reset system	A system reset is required to activate this feature. Sequence **reset system** press Enter The system responds: *Are you sure you want to reset? Y(yes) or N(no)* press **Y** The system will proceed to reset. You will have to log on again to regain access.

3.5.4 Downgrading System License Speed

Downgrading the system license speed to a value lower than previously purchased is supported. Information presented by the system, when downgraded, needs to be sent to DragonWave in order to confirm the status of your license.

NOTE: Once the system license speed has been downgraded, a new license key is required if you wish to return to a higher licensed speed.

Note that the licensed speed is the maximum speed that the system can operate at, regardless of the setting of the System Mode.

Procedure 3-8
Downgrading Horizon Compact System License Speed

Required Action	Steps
login	Log in as a NOC user.
get system speed	Returns the licensed speed value, the current set system speed and the set mode. Sequence: **get system speed** press Enter The system responds: *Licensed speed set to : n Mbps* *Current speed set to : n Mbps* *System mode set to : <system mode>* Example: Licensed speed set to :400 Mbps Current speed set to :400 Mbps System mode set to :hc50_364_256qam

Required Action	Steps
Downgrade system licensed speed	Downgrades the system licensed speed to operate at a lower maximum speed. **Warning: Once you issue this command your current license speed key will be lost and you will not be able to return to your original licensed speed without acquiring another license key from DragonWave.** Sequence: **downgrade system licensed speed [speed]** press Enter Where **[speed]** is the new lower licensed speed in Mbps. Example: d**owngrade licensed speed to 200** The system responds: (Example) *The current system licensed speed will be downgraded to 200 Mbps.* *This operation will force to save Mib. Continue? Enter Y(Yes) or N(No):y* *Saving MIB. Please wait for a while...* *Mib saved successfully.* *The current system licensed speed is downgraded to 200 Mbps.* *Downgrade Confirmation Information:* *Speed Decrement :200* *Speed Count :2* *Unit Serial Number :DW130AAG0100* *MAC Address :00-07-58-00-a2-16* *Confirmation Number :bc7ed7dd89a4d98adbab263630a9a27e* To determine the status of your license, the information shown above, under the heading “Downgrade Confirmation Information”, needs to be sent to DragonWave, along with the current licensed speed count (see next step).
Licensed speed count	This command returns the number of times that the licensed speed has been changed. This value is required by DragonWave, in addition to the information returned in the previous step, in order to determine the status of your license. Sequence : **get licensed speed count** press Enter The system responds : *Licensed Speed Counter is: 3* (Example)

Required Action	Steps
Licensed speed downgrade information	This command returns the licensed speed downgrade information that was presented during the downgrade process. This is the same information, along with the licensed speed count, that DragonWave needs in order to verify the status of your license. Sequence : **get licensed speed downgrade information** press Enter The system responds : (Example) *Downgrade Confirmation Information:* *Speed Decrement :200* *Speed Count :2* *Unit Serial Number :DW130AAG0100* *MAC Address :00-07-58-00-a2-16* *Confirmation Number :bc7ed7dd89a4d98adbab263630a9a27e*

3.6 Adaptive Transmit Power Control (ATPC)

Adaptive Transmit Power Control (ATPC) allows a Horizon Compact system to adjust its transmit power to compensate for far end signal loss caused by changes in atmospheric conditions e.g. heavy rain. ATPC maintains the RSL at -50 dB and adjusts the transmit power as necessary in order to maintain -50 dB during fade conditions.

RSL threshold levels that trigger power changes, the maximum power change allowed, and a hysteresis factor are preset at values which optimize the operation of the Horizon Compact system. A fade factor of 5dB/second can be handled.

The Horizon Compact system is able to discriminate between RSL levels that are reduced as a result of interference and those as a result of genuine path loss, so that ATPC is not invoked unnecessarily.

Some jurisdictions require the use of ATPC so that power levels are kept as low as possible when wireless communication conditions are good. When ATPC is to be used, if it can be shown that the maximum power of the system would be used only on infrequent occasions, some jurisdictions will allow a lower power level to be used in the calculations that determine interference criteria. This offers some advantage to the installation. This lower power is termed the “coordinated power”. The DragonWave ATPC feature supports a coordinated power parameter.

Note: If ATPC and Automatic Adaptive Modulation (AAM) are both enabled, when AAM is invoked i.e. modulation scheme switched to a lower level, ATPC is automatically disabled until AAM restores the original modulation scheme.

Procedure 3-9
Configure Horizon Compact Adaptive Transmit Power Control

Required Action	Steps
login	Log in as a NOC user.
get atpc status	Returns the current status of the atpc Sequence: **get atpc status** press Enter System responds: *Atpc is on/off*
set atpc	Enables or disables atpc. Sequence: **set atpc [on/off][coordinated power]** press Enter System responds: *Atpc is [on/off][coordinated power setting]*

Required Action	Steps
save mib	Saves the MIB to RAM. Perform this command to save setting changes to non-volatile memory. Sequence: **save mib** press Enter The system responds: *MIB saved successfully.*

3.7 Horizon Compact Authentication

This feature is only necessary if you wish to restrict communication from a Horizon Compact unit to a specific peer or to a group of Horizon Compact units. Authentication is generally used as a security measure. It is not recommended to enable Authentication prior to alignment of the radios.

Authentication restricts a Horizon Compact unit from communicating with other Horizon Compact units unless the other units match an authentication string. There are three types of authentication:

1. No Authentication
2. Unique Authentication
3. Group Authentication

A new Horizon Compact system inline with the signal cannot authenticate and receive data if another Horizon Compact system is already authenticated. The system authenticates its peer(s) at an interval of approximately five seconds.

Note: When Authentication is enabled it is recommended that out-of-band management (via Port 2) be used. This will prevent management access from being lost if an illegal attempt to access the system occurs, causing authentication to lock out management traffic from Port 1.

The Horizon Compact system does not accept data from other manufacturers' systems.

3.7.1 No Authentication

No Authentication is the default mode of operation for Horizon Compact. The Horizon Compact does not attempt to create a dialogue or establish authentication between Horizon Compact nodes. For No Authentication Mode, setting the failure condition has no effect since there is no dialogue or authentication between Horizon Compact systems. Any other Horizon Compact node transmitting on exactly the same frequency can send Ethernet data to the corresponding Horizon Compact node. The Horizon Compact only accepts data from other Horizon Compact nodes that:

a. are transmitting on the same frequency;
b. are properly aligned in polarity; and
c. have adequate signal strength.

The Horizon Compact system does not accept data from any other manufacturers' products.

3.7.2 Unique Authentication

Unique authentication establishes a dialogue between two Horizon Compact nodes. Unique authentication is used in a point-to-point configuration where two Horizon Compact systems communicate

only with each other and not any additional Horizon Compact systems. Once Unique Authentication is set, the Horizon Compact only accepts Ethernet data from its peer. It ignores all other sources of traffic arriving over the airwaves. Each node is programmed with its peer's identification number. Use CLI command **get hw inventory**. The Unit Serial Number is the identification number to be used. The identification number corresponds to the Unit Serial Number of the peer node. For example, endpoint A has a Unit Serial Number '1234' and endpoint B has Unit Serial Number '5678'. The peer identifier for endpoint B is '1234' (serial number of its peer) and the peer identifier for endpoint A is '5678' (serial number of its peer).

When you select Unique Authentication, you must set the authentication failure action.

3.7.3 Group Authentication

Group authentication is used when more than two Horizon Compact nodes communicate with each other and are contained within a geographical area under the control of a service provider or enterprise. The advantage of using Group Authentication for a group of Horizon Compact nodes is that only traffic destined for that particular network is accepted.

A group of Horizon Compact nodes uses a group ID to establish inter-node communication. Administrators create a group ID string consisting of up to eight characters. You must program the group ID string on each node. The group ID string can consist of the characters 0 to 9, a to z, and A to Z. Illegal characters that cannot be used are {! @ # $ % ^ &* (,) ; : ' " + - ~}.

3.7.4 Authentication Polling

When authentication is enabled, the system attempts to communicate (poll) a specified Horizon Compact node every five seconds to re-authenticate the node. If the Authentication Mode is set to NONE, the system does not attempt to authenticate.

When the corresponding nodes complete the authentication dialogue, the Horizon Compact reverts to normal operation. Once the corresponding nodes respond, authentication is re-established, operation reverts to normal, and any failure action reverts to normal.

The system reports an authentication failure if 24 polls receive no positive response. This means that there must be an authentication failure for approximately two consecutive minutes before the system determines there is a failure and reports it. An authentication failure is not necessarily an indication of a failed transmission issue. There are other alarms for issues with the transmission path such as loss of signal or loss of Ethernet traffic.

3.7.5 Authentication Failure Action

If authentication fails, you can specify how the Horizon Compact system responds:

- allow Ethernet traffic to continue to flow and do not raise an alarm , i.e., does nothing.
- allow Ethernet traffic to continue to flow, but raise an alarm.
- block the flow of Ethernet traffic.

Note: When Authentication is enabled it is recommended that out-of-band management (via Port 2) be used. This will prevent management access from being lost if an illegal attempt to access the system occurs, causing authentication to lock out Ethernet traffic (includes management) from Port 1.

Note: Authentication takes place out–of–band.

3.7.6 Configure Authentication

Should you require more security than offered by the default authentication mode of No Authentication, you will need to configure the authentication key to suit your requirements. Follow the steps in the following procedure.

Procedure 3-10
Setting Unique Authentication

Perform this procedure to set system authentication to unique.
Note: You must perform the authentication procedures in the sequence that they appear in this manual.

Required Action	Steps
login	Log in as a NOC user on both ends of the system and run the CLI command **get hw inventory** as shown below, to retrieve the authentication keys from each unit.
get hw inventory	Displays the serial numbers of the various sections in the system. Perform this command at each end of the link and record the authentication keys (Unit Serial Number) for each end. Sequence: **get hw inventory** press Enter The system responds: *Frequency File PartNumber : number* *Unit Serial Number : number* *Unit Assembly Number : number* *NCC Serial Number : number* *NCC Assembly Number : number* *IF Serial Number : number* *IF Assembly Number : number* *Radio Serial Number : number* *Radio Assembly Number : number* *Diplexer Serial Number : number* *Diplexer Assembly Number : number*

Required Action	Steps
set air interface authentication type	Sets the authentication type. This needs to be set to **unique**. The default type is none. Sequence: **set air interface authentication type [none, unique, group]** press Enter where **[none, unique, group]** identifies the authentication type. Use **unique** on this occasion. The system responds: *AIR INTERFACE AUTHENTICATION type set to : unique*
Set unique peer authentication key <xxxx>	Sets the unique peer authentication key of the peer node with which you wish to authenticate, generally the far-end unit. Sequence: **set unique peer authentication key <xxxx>** press Enter where **<xxxx>** is the Unit Serial Number of the **far-end** unit determined from the **get hw inventory** command performed earlier. The system responds: *Unique Peer Authentication Key: xxxx.* **Note:** You will need to repeat this procedure for each unit.
NOTE:	Once the unique authentication key is set, you will need to verify the authentication settings and set the authentication failure parameter before saving the mib and resetting the system. See Procedure 3-11.

This concludes the steps to setting authentication to unique.

Procedure 3-11
Setting Group authentication

Perform this procedure to set group authentication using the CLI manager.

Required Action	Steps
login	Log in as a NOC user.
Set air interface authentication type	Sets the authentication type. This needs to be set to **group**. The default type is none. Sequence: **set air interface authentication type [none, unique, group]** press Enter where **[none, unique, group]** identifies the authentication type. Use **group** on this occasion. The system responds: *AIR INTERFACE AUTHENTICATION type set to : group*
Set group authentication key	Sets the group authentication key. Sequence: **set group authentication key <xxxxxxxx>** press Enter where **<xxxxxxxx>** is a character string consisting of up to eight characters that may be: 0 to 9, a to z, and A to Z but may not contain any of the following: !@#$%^&*(,);:'"+-~ The system responds: *Group Authentication Key: xxxxxxxx.* **Note:** The <xxxxxxxx> is the unique eight-character string you have assigned to be the group authentication key. You will need to repeat this procedure for each unit in the group that uses the same group key.
NOTE:	Once the group authentication key is set, you will need to verify the authentication settings and set the authentication failure parameter before saving the mib and resetting the system. See Procedure 3-11**.**

This concludes the steps to set the group authentication key using the CLI manager

Procedure 3-12
Verify Authentication status

Use this procedure to verify the authentication action for the system.
Note: To perform this procedure, you must be logged into the system as an NOC user.

Required Action	Steps
login	Log in using a NOC account.
Get authentication status	Displays the authentication status between two corresponding Horizon Compact systems. Sequence: **get authentication status** press Enter Where **[authentication Status]** is one of the following: Authenticated NotAuthenticated ExplicitAuthenticationFailure The system responds: *Authentication status:* *[AuthenticatedNotAuthenticatedExplicitAuthenticationFailure]* Explanations: If authentication has failed: check the setting for action on authentication failure; and ensure it is not set to Block Traffic (unless that is the intended action). If authentication has not failed: check to see if traffic is now flowing. If traffic is flowing then the authentication has been re-established and the system is operating normally If traffic is not flowing, the problem is not due to authentication.
set authentication failure [block_traffic/pass_traffic]	Configures the action to take on peer authentication failure. Sequence: **set authentication failure [block_traffic/pass_traffic]** press Enter The system responds: *System will [block_traffic/pass_traffic] on peer authentication failure.* .

Required Action	Steps
save mib	Saves the MIB to RAM. Perform this command to save setting changes to non-volatile memory. Sequence: **save mib** press Enter The system responds: *MIB saved successfully.*
Reset system	A system reset is required to activate this feature. Sequence **reset system** press Enter The system responds: *Are you sure you want to reset? Y(yes) or N(no)* press **Y** The system will proceed to reset. You will have to log on again to regain access.

This concludes the steps to verify the authentication status using the CLI manager.

3.8 Threshold Alarms

Horizon Compact provides Threshold Alarms to assist in managing the performance of the system. Threshold alarms are available for the following parameters:

1. RSL (Receive Signal Level)
2. Signal To Noise (SNR)
3. Bandwidth Utilization
4. Dropped Frames

Each Threshold Alarm has two associated parameters:

1. Threshold value
2. A time limit over which the Threshold value must be exceeded before the alarm is reported.

The combination of the value and the time limit is user defined. The proper combination of the two parameters will prevent false alarms from occurring.

Procedure 3-13
Configure Threshold Alarms

Perform this procedure to configure the Threshold Alarms for the Horizon Compact system. Each Threshold Alarm may be configured independently of each other, and each end of the link may be configured for different values.

Note: To perform this procedure, you must have NOC user rights.

Required Action	Steps
login	Log in as a NOC user.
get RSL threshold alarm settings	Displays the current settings for the Threshold Alarm for the Receive Signal Level (RSL). Once the RSL Value Threshold is reached and continues for the Time Limit duration then an alarm is raised. Sequence: **get rsl threshold** press Enter The system responds: *RSL threshold set to : <rsl value> dbm* *RSL timelimit set to : <timelimit> secs* Where **<rsl value>** is the current RSL value in integers, given in dBm. **<timelimit>** is the current time limit that the condition must occur before the alarm is raised. Timelimit is in integers, given in number of seconds

Required Action	Steps
set RSL threshold alarm settings	Sets the current settings for the Threshold Alarm for the Receive Signal Level (RSL). Once the RSL Value Threshold is reached and continues for the Time Limit duration then an alarm is raised. Sequence: **set rsl threshold <rsl value> <timelimit>** press Enter Where **<rsl value>** is the desired RSL value in integers, given in dBm. **<timelimit>** is the desired time limit that the condition must occur before the alarm is raised. Timelimit is in integers, given in number of seconds The system responds: *RSL threshold set to : <rsl value> dbm* *RSL timelimit set to : <timelimit> secs*
get snr threshold	Returns the current signal to noise ration alarm threshold. Sequence: **get snr threshold** press Enter The system responds: *SNR threshold set to : n* Where *n* is the current SNR threshold setting
set snr threshold	Sets the SNR level below which a threshold alarm will be raised. Sequence: **set snr threshold <snr value>** press Enter Where <snr value> is in dB and between 0 and 30 The system responds: *SNR threshold set to : n* Where *n* is the new SNR threshold setting

Required Action	Steps
get bandwidth utilization threshold alarm settings	Displays the current settings for the Bandwidth Utilization Threshold Alarm. Sequence: **get bandwidth utilization threshold** press Enter The system responds: *Bandwidth utilization threshold set to : <value> % Bandwidth utilization timelimit set to : <timelimit> secs.* Where **<value>** is the current bandwidth utilization value expressed in percentage **<timelimit>** is the desired time limit that the condition must occur before the alarm is raised. Timelimit is in integers, given in number of seconds
set bandwidth utilization threshold alarm settings	Sets the values for the Threshold Alarm for the Bit Error Rate (BER) as calculated by the Horizon Compact modem. Once the BER Value Threshold is reached and continues to remain between the Threshold value and the hysteresis value, then an alarm is raised. Once the value drops below the hysteresis value then the alarm is cleared. Sequence: **set bandwidth utilization threshold <value> <timelimit>** press Enter Where **<value>** is the current bandwidth utilization value expressed in percentage **<timelimit>** is the desired time limit that the condition must occur before the alarm is raised. Timelimit is in integers, given in number of seconds. Default value is 10 seconds The system responds: *Bandwidth utilization threshold set to : <value> % Bandwidth utilization timelimit set to : <timelimit> secs.*
get dropped frames threshold alarm settings	Displays the current settings for the Dropped Ethernet Frames Threshold Alarm. Sequence: **get dropped frames threshold** press Enter The system responds: *Dropped frames threshold set to : <value> %* *Dropped frames timelimit set to : <timelimit> secs.* Where **<value>** is the current dropped frames value expressed in percentage **<timelimit>** is the desired time limit that the condition must occur before the alarm is raised. Timelimit is an integer, given in number of seconds

Required Action	Steps
set dropped frames threshold alarm settings	Sets the values for the Dropped Ethernet Frames Threshold Alarm. As the Horizon traffic rate from the LAN side exceeds the programmed limit, frames are dropped in order to maintain the limit. Sequence: **set dropped frames threshold <value> <timelimit>** press Enter Where **<value>** is the current dropped frames value expressed in percentage **<timelimit>** is the desired time limit that the condition must occur before the alarm is raised. Timelimit is in integers, given in number of seconds. Default value is 10 seconds. The system responds: *Bandwidth utilization threshold set to : <value> % Bandwidth utilization timelimit set to : <timelimit> secs.*
save mib	Saves the MIB to RAM. Perform this command to save setting changes to non-volatile memory. Sequence: **save mib** press Enter The system responds: *MIB saved successfully.*

This concludes the steps to configure Threshold Alarms for the Horizon Compact system using the CLI manager.

3.9 Rapid Link Shutdown (RLS)

Networks containing alternate or redundant routing paths will typically rely on protocols such as Rapid Spanning Tree Protocol (RSTP) to invoke a reroute when communications to the far end unit fail or experience high data error rates. The protocols are implemented on the Ethernet switch and rely on polling or messaging to determine that communications to the far end has been disrupted. Although very effective, these protocols can result in slow reaction times to determine link issues. It is often desirable to inform a switch or router of a network issue in the quickest manner possible. The Horizon Compact system provides the Rapid Link Shutdown feature for this purpose. Notification to the switch or router is provided by shutting down the Ethernet ports connecting the Horizon Compact systems to the network. The Ethernet ports at both ends of the link are shut down. The Ethernet switch immediately recognizes the loss of Ethernet connection and invokes its alternate path algorithm.

The default setting for RLS is OFF, meaning that the Ethernet port will remain connected during failure conditions.

Notes:

1. RLS cannot be invoked if Automatic Adaptive Modulation (AAM) is enabled, or if 1+1 Redundancy is enabled.
2. RLS should be disabled during link alignment to prevent the condition where a link goes in and out of synchronization resulting in the RLS being invoked and released causing loss of Ethernet management to the systems.
3. A disconnected Ethernet cable at one end of the link will trigger an RLS event and will result in the Ethernet port on the other end being shut down if RLS is enabled.

Determination of Error Rates on Horizon Compact Systems

Horizon Compact systems employ forwards and backwards error correction to compensate for and correct errors occurring over the RF link. Once these errors are corrected, the user data can flow error-free. The post-correction data error rate is reported as "Modem Block Receive Errors" within the Horizon Compact, accessible through traffic statistics in CLI or through the Performance web page. Modem Block Error Rate is also available and is reported in scientific notation.

The Horizon Compact systems communicate with each other via “modem blocks” at all times even if there is no Ethernet traffic. The modem blocks are transmitted at a fixed rate and therefore a modem block error rate is also available. The incoming Ethernet data stream is treated as a bit stream and sub-divided into modem blocks for transmission over the RF link. Modem blocks are continuously transmitted to the far end modem regardless of whether or not Ethernet traffic exists. Modem blocks are less than 256 Bytes in length including overhead. The modems transmit approximately 59,000 blocks per second on a 100 Mbps link. In order to determine a modem block error rate of 1x10e-6 there would have to be a minimum of 1 million modem blocks transmitted. At 59,000 blocks per second, it would take 16.8 seconds to transmit 1 million blocks. A facility exists in the Horizon Compact that allows the sample time to be shortened (see “soft” Error mode below).

Horizon introduces enhancements to the DragonWave RLS functionality consisting of:

- The fade monitor (“soft failure” mode) has been simplified to analyze the modem block error rate over time increments. RLS will trigger when the user-configurable error rate threshold is exceeded
    - The enhancements include the addition of a “make” sample time parameter (“make” relates to the re-establishment of the link), whereas previously the same sample time was used for both “make” and “break” (“break” relates to the shutting down of the link).
- A “hard failure” mode has been introduced that triggers on a percentage of errored packets on a link. This mode is applicable to link outages or severely degraded data transfer.
    - The default value of error threshold is a loss of 50% of modem blocks (packets) over a default sample time of 50 msec. The sample time and error threshold are user-configurable.
- Enhancement to RLS Advanced Mode providing support for a combined “hard”/”soft” failure mode

  - Fast RLS switch for “hard” failure (severe degradation or link outage)
  - Longer sample time and RLS switch for “soft” failure (high error rate)
- Increased flexibility in setting a larger differential for “break vs. make” error values
- Addition of a Receive Signal Level “RSL” threshold monitor to be optionally used in “make” criteria for link startup

RLS Configuration

When RLS is enabled there are two options available for determining when RLS should be invoked to shut down the Ethernet ports. These are the basic and advanced modes.

Basic Mode

In basic mode, the user can configure the modem-to-modem block error rate thresholds under which RLS will be invoked and the Ethernet ports disabled. The user can also set the thresholds for which RLS will be revoked and the Ethernet ports brought back to service. Complete link outages due to loss of Ethernet connectivity, loss of RF path, hardware failure, or power failure will trigger an RLS event and the modem’s Ethernet ports will be shut down until the outage is repaired.

The basic mode relies on the follow situations occurring:

“Soft” failure. This mode monitors the link for data errors either as a steady state error rate or bursts of data errors.

a. The RLS signal degrade settings correspond to “soft” failure mode.
b. The value being monitored is Modem Receive Block Errors. RF link errors are typically corrected by the modem and therefore no user data errors occur. The Modem Receive Block Errors value is a true representation of user data errors occurring between the modems.
c. The sample time is user configurable
d. An RLS signal degrade threshold setting in percentage is available to allow shorter sampling times should errors occur on a frequent basis.

NOTE: It is recommended to use the Advanced Mode enhancements available in Release 4.5.

Advanced Mode

The advanced mode relies on any one of three situations occurring:

1. Link outage, which could be the result of link quality issues due to weather or path obstruction, hardware failure, power or failure.
   a. A link outage will trigger an immediate RLS condition.
2. “Hard” failure. This mode invokes RLS when the link has deteriorated to a point of a massive amount of data errors being received over the link.
   a. The RLS signal fault parameters correspond to “hard” failure mode.
   b. The user-configurable error rates vary from 50% to 100%.
   c. The user-configurable sample time ranges from 5 msec to 100 msec.

   Example: 50% error rate over the link for a 100 msec time period will invoke RLS.
3. “Soft” failure. This mode monitors the link for data errors either as a steady state error rate or bursts of data errors.
   a. The RLS signal degrade settings correspond to “soft” failure mode.
   b. The value being monitored is Modem Receive Block Errors. RF link errors are typically corrected by the modem and therefore no user data errors occur. The Modem Receive Block Errors value is a true representation of user data errors occurring between the modems.
   c. The sample time is user configurable
   d. An RLS signal degrade threshold setting in percentage is available to allow shorter sampling times should errors occur on a frequent basis.

All three – link outage, “hard” failure and “soft” failure - work in concert. While monitoring for a “soft” failure, a link outage will invoke RLS immediately. Similarly, while monitoring for a “soft” failure, a “hard” failure condition will trigger an RLS event.

Note: When selecting Advanced Mode, both the “hard” failure mode and “soft” failure mode are to be configured.

3.9.1 Settings for Basic Mode

NOTE: although basic mode is available in order to provide a software upgrade path from previous software releases, it is recommended to use the Advanced Mode enhancements available in Release 4.5. The Advanced Mode has been simplified with respect to user calculations.

Basic mode relies on RLS link monitor parameters consisting of errors in data transfer between the modems. It monitors modem block errors and the user configures the number of errors and sampling time for those errors for both the invocation and revocation of RLS.

3.9.1.1. RLS Signal Degrade Settings

These settings correspond to “soft” failure mode. The RLS signal degrade settings are designed to detect and react to persistent, low-level modem block error rates. Use of the signal degrade threshold parameter can accelerate the error detection and reaction process when excessive block error rates occur. RLS signal degrade detection is used in RLS Basic mode and consists of two commands.

1. **set rls signal degrade parameters**
2. **set rls signal degrade threshold**

set rls signal degrade parameters [up err rate] [dn err rate] [up time] [dn time]

Note: This command is overridden by the **set rls link monitor parameters** command described in Section 3.9.1.2.

The RLS signal degrade parameters consist of four values. These values are:

- **[up err rate]** The link should experience block error rates equal to or better than this value to de-activate RLS, and restore the data Ethernet port. The error rate parameter is entered in scientific notation. (Example – 1.0e-06)
- **[dn err rate]** The link should experience block error rates equal to or worse than this value to activate RLS and disable the data Ethernet port. The error rate parameter is entered in scientific notation. (Example – 1.0e-05)
- **[up time]** The amount of time, in milliseconds, that the link must meet the **[up err rate]** condition before RLS is de-activated. (Example – 168000)
- **[dn time]** The amount of time, in milliseconds, that the link must meet the **[dn err rate]** condition before RLS is activated. (Example – 16800)

The **[up time]** and **[dn time]** parameters are optional. If the time parameters are not supplied the system will default to 3 times the sample time required to detect the configured modem block error rate.

set rls signal degrade threshold [percent]

Note: This command is overridden by the **set rls link monitor parameters** command described in Section 3.9.1.2.

The RLS signal degrade threshold command accepts a single parameter. It is the minimum percentage of the sample time which can be used to record an error. The default value is 100 (%). A setting of 100 % means that the system will monitor for the full sample time, even if enough errors are recorded to exceed the programmed error rate. Setting the signal degrade threshold to 50 (percent) would allow the system to begin a new sample period at 50%, or half, of the normal sample time if the error threshold had been reached by that point.

Using the recommended two sample periods, and a signal degrade threshold of 50 % with excessive error rates, RLS activation can occur within half the time that would normally be required for activation. The example used in section 8.8.1.1 would then activate RLS within 16.8 seconds when experiencing an extreme error rate versus the normal 33.6 seconds.

The following is an optional command.

set rls make rsl [RSL Threshold (dB)] [Sample Period (sec)]

This command sets the minimum RSL value that will re-establish, or "make", the link.

Example: **set rls make rsl -60.0 100**

When the RSL level is maintain at -60.0 or a higher value (less negative) for the duration of the sample period 100 seconds), the link will be re-established.

Setting the RSL sample period to zero (0), the default value, disables this feature.

3.9.1.2. RLS Link Monitor Parameters

This CLI only command provides a custom method for the configuration on the "soft error" monitor. The method directly configures the sampling period, required repeated consecutive samples and the erred block thresholds per period of the "soft error" monitor. This method allows additional low-level tuning of the "soft error" monitor.

Note: When this command is used, it overrides the **set rls signal degrade parameters** and **set rls signal degrade threshold** commands invoked by CLI, Web or SNMP methods.

The RLS link monitor parameters are a measure of the number of block errors per designated sampling time period. The user configures the RLS settings for:

- the sampling time in milliseconds
- the number of samples in which the block errors must occur
- the number of desired block errors required in order to invoke RLS

Command syntax:

set rls link monitor parameters [dn2up block errors per sample] [up2dn block errors per sample] [dn2up # of samples] [up2dn # of samples] [dn2up sample time in msec] [up2dn sample reset time in msec]

Please contact DragonWave Customer Support for assistance if the default "soft error" monitor behaviour needs to be tuned for a specific application.

3.9.2 Settings for Advanced Mode

Advanced Mode is the recommended mode for RLS implementation.

Note: When selecting Advanced Mode, both the “soft” failure mode (Basic mode parameters) and “hard” failure mode (Advanced mode parameters) are to be configured.

3.9.2.1. RLS Signal Fault Settings

These settings correspond to “hard” failure mode The RLS signal fault settings are designed to detect and react to brief bursts of extreme modem block error rates. The RLS signal fault detection and reaction time is the quickest of the two RLS fault detection methods. RLS signal fault detection works with the RLS signal degrade settings in Advanced mode.

set rls signal fault parameters [detect time] [percentage errored blocks]

The RLS signal fault parameters command accepts two parameters. **[detect time]** is the time, in milliseconds, that the **[percentage errored blocks]** threshold must be met to activate RLS. **[percentage errored blocks]** is the percentage of errored modem blocks to activate RLS on. For example, the command “set rls signal fault parameters 1000 50” will activate RLS when 50% or more of the modem blocks received in 1000 milliseconds are errored.

3.9.2.2. Recovery from a Hard Failure

Once a “hard” failure has caused an RLS activation, it uses the “soft” failure - RLS signal degrade parameters – to determine the length of time to wait before reactivating the Ethernet ports.

3.9.3 RLS Link Control Settings

By default, the disabling and enabling of the data Ethernet port is automatically managed by the Horizon Compact system in response to detected RLS events. It is possible to enable manual control of RLS shutdowns, so that the data Ethernet port remains shutdown until a user explicitly re-enables it. There are two commands that make up RLS link control, namely rls link control and rls link enable.

set rls link control [on/off]

To enable manual control of the data Ethernet port link state, set rls link control to **on**. The default setting is **off**, allowing the Horizon Compact to re-enable the data Ethernet port once the RLS condition is cleared.

set rls link enable [on/off]

When **rls link control** is set to **on**, the data Ethernet port remains in a shutdown state after the RLS condition has been cleared. The Ethernet port can be manually re-enabled by issuing the **set rls link enable on** command. The **set rls link enable off** command disbles the Ethernet port.

Procedure 3-14
Configure Rapid Link Shutdown Options

Perform this procedure to configure the Rapid Link Shutdown Options for the Horizon Compact system. When RLS is used, the Horizon Compact Port 1 will be set to "down" during modem-to-modem communication failure. This feature allows a router to select an alternate path should the modem-to-modem communications fail.

Note: To perform this procedure, you must have NOC user rights.

Required Action	Steps
login	Log in as a NOC user.
get rls	Displays the state of the Rapid Link Shutdown feature. RLS provides the ability to shut down the Horizon Compact Ethernet link (both endpoints) during system outages. The default is "off". Sequence: **get rls** press Enter The system responds: *RLS option is :[off/on].*
rls status	Displays the detailed status of the RLS configuration. Sequence: **get rls status** press Enter The system responds (Example): *RLS Option: On Advanced* *Rapid Link Shutdown: Activated* *RLS Peer Mismatch: Activated* *Degrade Monitor State: Activated* *Hard Fault Monitor State: Acitvated* *Make RSL Threshold: OK* *Peer RLS State: OK* *Radio Interface State: Up* *Network Interface State: Down* *User Configured Establish FER: 8.82E-07* *Minimum Achievable Establish FER: 3.06E-07* *User Configured Shutdown FER: 1.76E-04* *Minimum Achievable Shutdown FER: 3.06E-06* *User Configured Establish Monitor Time(mSec): 40000* *Actual Establish Monitor Time(mSec): 45517* *User Configured Shutdown Monitor Time(mSec): 3000* *Actual Shutdown Monitor Time(mSec): 4550*

Required Action	Steps
set rls [on/off] [basic/advanced]	Turns the Rapid Link Shutdown (RLS) feature on or off. Turning RLS on, with the optional "advanced" feature, enables use of the signal fault monitor as well as the signal degrade monitor. Setting RLS on without issuing the basic or advanced command defaults to RLS on, basic. RLS provides the ability to shut down the Horizon Compact Ethernet ports (Port 1 on both endpoints) during system outages. Note: a save mib and reset system command must be issued in order for the rls setting to take effect. The default is "off". Sequence: **set rls [on/off] [basic/advanced]** Press Enter The system responds: *RLS option [on/off][basic/advanced]* *Where* *On means the RLS function is active.* *Off means the RLS function is inactive.*
get rls link control	Displays the state of the Rapid Link Shutdown (RLS) link control feature. RLS provides the ability to shut down the Horizon Compact Ethernet ports (Port 1 on both endpoints) during system outages. The RLS link control feature determines how the system will react when link recovery takes place, either providing automatic recovery of the Ethernet ports by the Horizon Compact system or waiting for the user to manually recover the Ethernet ports through use of the "set rls link enable on" command. The default is "off". Sequence: **get rls link control** press Enter The system responds: *RLS link control option is set to [on/off]* Where On means the user has to re-establish the Ethernet connection by using the "set rls link enable on" command Off means the system will auto-recover the Ethernet connection.

Required Action	Steps
set rls link control [on/off]	Determines whether RLS link control performs automatic recovery or requires manual recovery of the Ethernet port. RLS provides the ability to shut down the Horizon Compact Ethernet ports (Port 1 on both endpoints) during system outages. The user can manually recover the Ethernet ports through the use of the "set rls link enable on" command. The default is "off". Sequence: **set rls link control [on/off]** press Enter The system responds: *RLS link control is set to [on/off]* *Where* *On means the user must manually recover the Ethernet port through the use of the "set rls link enable on" command.* *Off means the Horizon Compact system will automatically recover the Ethernet port.*
get rls link enable	Displays the state of the Rapid Link Shutdown (RLS) link enable feature. RLS provides the ability to shut down the Horizon Compact Ethernet ports (Port 1 on both endpoints) during system outages. The default is "off". Sequence: **get rls link enable** press Enter The system responds: *RLS link enable is set to [on/off]* *Where* *On means to re-enable the Ethernet port on the modem* *Off means the Ethernet port is not re-enabled.*
set rls link enable [on/off]	Manually enables or disables the Horizon Compact Ethernet link. This feature requires the rls link control feature to be "on". The default is "off". Sequence: **set rls link enable [on/off]** press Enter The system responds: *RLS link enable is set to [on/off]* *Where* *On means to re-enable the Ethernet port on the modem* *Off means the Ethernet port is not re-enabled.*

Required Action	Steps
set rls signal degrade parameters [up err rate] [dn err rate] [up time] [dn time]	The RLS signal degrade parameters are used in both Basic and Advanced RLS modes. The parameters supplied determine the conditions under which RLS will disable and re-enable the Horizon Compact data Ethernet port (Port 1). Sequence: **set rls signal degrade parameters [up err rate] [dn err rate] [up time] [dn time]** press Enter Where **[up err rate]** is the target block error rate required to re-enable the data Ethernet port. The current block error rate must be equal to or better than this value. The target rate is expressed in Scientific Notation. **[dn err rate]** is the target block error rate required to activate RLS and disable the data Ethernet port. The current block error rate must be equal to or worse than this value. The target rate is expressed in Scientific Notation. **[up time]** is the time, in milliseconds, to sample the data stream to determine if the [up err rate] condition has been met. Note that the system will round this value up to the nearest multiple of the minimum sample time required to detect the [up err rate]. **[dn time]** is the time, in milliseconds, to sample the data stream to determine if the [dn err rate] condition has been met. Note that the system will round this value up to the nearest multiple of the minimum sample time required to detect the [dn err rate]. The default settings are 9.00E-07 1.00E-05 120000 20000 The system responds: *RLS Degrade Monitor Parameters: 9.00E-07 1.00E-05 120000 20000*

Required Action	Steps
set rls signal degrade threshold [min degrade threshold]	This option is the minimum percentage of the sample time which can be used to record an error. The default value is 100. A setting of 100 (percent) means that the system will monitor for the full sample time, even if enough errors are recorded to exceed the programmed error rate. Decreasing the threshold allows the link to be shutdown faster when higher block error rates are observed. The default is "100", meaning 100% of the sample time. Sequence: **set rls signal degrade threshold [min degrade threshold]** press Enter Where [minimum degrade threshold] is a percentage and sets the min degrade threshold before link shut down. The threshold is a percentage of the total [degrade time msec] The system responds: *RLS link enable is set to [on/off]*
set rls make rsl	This is an optional command. This command sets the minimum RSL value required to re-establish, or “make”, the link. Sequence: **set rls make rsl [RSL (dB)] [Duration (sec)]** press Enter The system responds: RLS Make RSL Parameters: [RSL (dB)] [Duration (sec)] Example: **set rls make rsl -60.0 100** When the RSL level is maintain at -60.0 or a higher value (less negative) for the duration of the sample period (100 seconds), the link will be re-established. Setting the RSL sample period to zero (0), the default value, disables this feature.

Required Action	Steps
set rls link monitor parameters	This is a custom method for the configuration of the “soft error” monitor. The method directly configures the sampling period, required repeated consecutive samples and the errored block thresholds per period of the “soft error” monitor. This method allows additional low-level tuning of the “soft error” monitor. **Note:** When this command is used, it overrides the **set rls signal degrade parameters** and **set rls signal degrade threshold** commands invoked by CLI, Web or SNMP methods. Sequence: **set rls link monitor parameters [dn2up block errors per sample] [up2dn block errors per sample] [dn2up # of samples] [up2dn # of samples] [dn2up sample time in msec] [up2dn sample reset time in msec]** Please contact DragonWave Customer Support for assistance if the default “soft error” monitor behaviour needs to be tuned for a specific application.
get rls signal fault parameters	The RLS signal fault settings are designed to detect and react to brief bursts of extreme modem block error rates or link outages. The RLS signal fault detection and reaction time is the quickest of the two RLS fault detection methods. RLS signal fault detection works with the RLS signal degrade settings in Advanced mode. Sequence: **get rls signal fault parameters** The system responds: *RLS Signal Fault Parameters: 1000 100*

Required Action	Steps
set rls signal fault parameters [fault period msec] [fault threshold]	Sets the RLS signal fault monitor parameters. The RLS signal fault settings are designed to detect and react to brief bursts of extreme modem block error rates. The RLS signal fault detection and reaction time is the quickest of the two RLS fault detection methods. RLS signal fault detection works with the RLS signal degrade settings in Advanced mode. Sequence: **set rls signal fault parameters [fault period msec] [fault threshold]** press Enter Where **[fault sample period msec]** is the sample period to apply Fault Threshold ratio **[fault threshold percentage]** is the ratio of 'fault sample period' faulted before the link is shut down. The system responds: *RLS Signal Fault Parameters: 1000 100*
save mib	Saves the MIB to RAM. Perform this command save setting changes to FLASH. This command does not restart the system and does not put any new settings into effect. A system reset command will cause settings in RAM to be programmed into FLASH and to take effect. Sequence: **save mib** press Enter The system responds: *MIB saved successfully.*
reset system	Resets the system to save the settings to FLASH and restart the system with the new settings taking effect. Sequence: **reset system** press Enter The system responds: *Are you sure you want to reset? Y(yes) or N(no)* press **Y** Once the system reboots, login and continue with the RLS configuration.

This concludes the steps to configure Rapid Link Shutdown for the Horizon Compact system using the CLI manager.

3.10 Configuring the Time Source (SNTP)

The time and date can be entered into the Horizon system. This is maintained for as long as power is applied to the system. If power fails, then all timing information is lost. An accurate clock is necessary for time stamping entries in the events and performance logs.

To maintain the time and date in the system, five network sources of timing information are configurable.

Up to five time sources can be configured, which can provide accurate time and date information to the system. Simple Network Time Protocol (sntp) is used.

Five time sources are configured by default. Each time source is indexed 1 to 5. Indices 1 and 2 are from Industry Canada servers, 3 and 4 are from U.S. Navy servers and 5 is from a Swiss server. Any other time sources can be configured. The timing information is polled every 60 minutes.

Table 3-6 Time Sources

Index	Stratum	Source IP Address	Source
1	2	199.212.17.15	Industry Canada
2	2	199.212.17.20	Industry Canada
3	1	192.5.41.40	U.S. Navy
4	1	192.5.41.209	U.S. Navy
5	2	129.132.2.21	Switzerland

Procedure 3-15
Configuring the Horizon Time and Date

Required Action	Steps
login	Log in as a NOC user.
get date time	Returns the current date and time on the system. Sequence: **get date time** press Enter The system responds: *Date and Time : 15/06/2007 14:17:42:237*
set date time	Sets the system date and time if SNTP is not enabled. Sequence: **set date time [dd/mm/yyyy hh:mm:ss:ms]** Where dd – day (01 – 31) mm – month (01 – 12) yyyy – year (1970 – 2099) hh – hour (0 – 23) mm – minutes (0 – 59) ss – seconds (0 – 59) ms – milliseconds (0 – 999) The system responds: *Date and Time : [dd/mm/yyyy hh:mm:ss:ms]*
save mib	Saves the MIB to RAM. Perform this command save setting changes to non-volatile memory. Sequence: **save mib** press Enter The system responds: *MIB saved successfully.*

Procedure 3-16
Configuring the Time Source

Required Action	Steps
login	Log in as a NOC user.
get sntp	*Displays the current time settings. This example shows the Horizon Compact system default settings.* *Sequence :* **get sntp** *The system responds :* *SNTP feature is turned on.* *Current system time: 12/10/2005 15:36:54. Last SNTP synch: 12/10/2005 15:27:41.* *Index | Status | Stratum | Name* *1 Good 2 199.212.17.15* *2 Good 2 199.212.17.20* *3 Good 1 192.5.41.40* *4 Good 1 192.5.41.209* *5 Good 2 129.132.2.21* ***Notes: SNTP servers are polled every 60 minutes.* *Search for SNTP server always starts at index 1, for every poll.* *System time will be set to first server found, every poll period.* *Stratum level supplied by SNTP server. 0 indicates not available.* *You can force a re-synch to all servers by setting SNTP 'on'.* *System will not automatically adjust to Daylight Savings Time.*
get sntp offset	*Displays the number of hours offset from GMT entered into the system.* *Sequence :* *get sntp offset* *The system responds (example shows an offset of -1.5 hours) :* *System time offset from GMT: -1.5 hours.* ***Notes: System will not automatically adjust to Daylight Savings Time.* *North America requires negative offset from GMT e.g. -5.0 hours*

Required Action	Steps
set sntp server	*Allows a new time source server to be entered.* *Sequence :* **set sntp server [index] [ip address]** *Where **[index]** is a number 1 to 5 corresponding to the desired time source index to be changed, and **[ip address]** is the ip address of the server providing the new time source.* *The system responds :* *Success: SNTP server information accepted.*
set sntp offset	*Allows the time difference from GMT to be entered, so that local time is available to the system.* *Sequence :* **set sntp offset [offset hours]** Note that the offset hours can be negative or positive, depending on your location relative to Greenwich, U.K. The maximum offset accepted is ±14 hours The system responds : *System time offset from GMT: [offset hours] hours.* ***Notes: System will not automatically adjust to Daylight Savings Time.* *North America requires negative offset from GMT e.g. -5.0 hours*
set sntp default	*Sets the five timing sources to the default values shown in the **get sntp** command shown at the beginning of this exercise.* *Sequence :* **set sntp default** *The system responds :* *SNTP default values will now be used.*
save mib	Saves the MIB to RAM. Perform this command save setting changes to non-volatile memory. Sequence: **save mib** press Enter The system responds: *MIB saved successfully.*

3.11 Automatic Adaptive Modulation

The two principal modulation schemes used on the Horizon Compact system are QPSK and QAM. QPSK (the lowest modulation scheme) is ideal for long distance, but has the lowest throughput capability.

Higher throughputs are achieved by using more complex modulation schemes e.g. 16-QAM, 32-QAM, 64-QAM, 128-QAM, 256-QAM. The higher numbers indicate a progressively more complex scheme and a higher bandwidth (throughput) capability e.g. 256-QAM is more complex than 128-QAM and provides a higher throughput. More complex modulation schemes are susceptible to noise and thus require a stronger signal for the demodulator to accurately decode the data stream. Consequently, the more complex the modulation scheme used, the shorter the distance limitation of the radio link.

If a system is using a given modulation scheme and weather conditions cause signal levels to deteriorate below acceptable levels (risking a link failure), changing the modulation scheme to a less complex scheme, will allow the link to remain functional, but with a lower throughput, until weather conditions improve. The modulation scheme can then be returned to the original scheme and the throughput returned to normal levels.

The Horizon Compact system can be configured to automatically change modulation schemes if environmental conditions deteriorate to the point where a wireless link may otherwise fail. This feature is called Automatic Adaptive Modulation (AAM). Note that AAM cannot be invoked if RLS is enabled.

The system will cause the current system mode (which determines the modulation scheme) to be changed to the available system mode having the lowest modulation scheme (a number of system modes, which includes the modulation scheme, are available for any given radio band, see Volume 1), if the Horizon Compact units lose Modsync for 5 seconds or more.

The original modulation scheme (system mode) will be restored once preset parameters indicate that conditions are suitable for returning to the original modulation scheme (and return to the original bandwidth).

Note that if ATPC is active when an AAM downshift is invoked, any reduced power setting incurred as a result of ATPC will be overridden and the power setting adjusted to the highest possible for the applicable modulation scheme (system mode). When AAM reverts back to normal modulation, the power level will remain at that last set during the modulation downshift (high), leaving ATPC to adjust the power to an appropriate value.

The total outage time due to modulation downshift is typically 1 to 2 seconds on average. The time taken to return to the original modulation scheme (upshift) is typically 100 mS to 300 mS.

AAM is supported by all radio bands available to the Horizon Compact, however, some jurisdictions may not allow its use.

There are three CLI commands associated with AAM:

- **get aam status**
- **set aam <on/off>**
- **diagnose aam <up/down>**

The first two commands are shown in the procedure below. The third command is for diagnostic purposes and enables the user to force the modulation scheme to one state or the other.

Procedure 3-17
Configuring Automatic Adaptive Modulation

Required Action	Steps
login	Log in as a NOC user.
get aam status	Displays the current status of the Automatic Adaptive Modulation setting. Note that AAM cannot be invoked if RLS is enabled. Sequence : **get aam status** press Enter The system responds : *Aam set to:on/off*
set aam	This command turns the Automatic Adaptive Modulation (AAM) option on or off. Note that AAM cannot be invoked if RLS is enabled. Sequence : **set aam <on/off>** press Enter The system responds : *Aam set to:on* *Save mib and restart system.* OR *Aam set to:off*
save mib	Saves the MIB to RAM. Perform this command to save setting changes to non-volatile memory. Sequence: **save mib** press Enter The system responds: *MIB saved successfully.*
Reset system	A system reset is required to activate this feature. Sequence **reset system** press Enter The system responds: *Are you sure you want to reset? Y(yes) or N(no)* press **Y** The system will proceed to reset. You will have to log on again to regain access.

3.12 Horizon Redundancy

The Horizon system can be configured for redundancy using two physical options. One option allows for two separate Horizon units, each with its own antenna, and each having the P1 Payload port connected to a switch or router. This option is termed the “2-wire” approach, since there are 2 P1 Payload wires or Ethernet cables connected to the local Ethernet switch.

The second option has two Horizon units fed from a single P1 Payload connection to a switch or router. This option is termed the “single wire” or “1-wire” approach.

In either case, a management cable is connected from Horizon Compact to the Ethernet switch. In a 1-wire redundancy configuration, there is one Management cable and in a 2-wire redundancy configuration there are two Management cables. In a 1-wire redundancy configuration, the management port is activated on P1 of the Secondary unit and P2 of the Primary unit. In a 2-wire redundancy configuration, management is configured on P2 of both the Primary and Secondary units.

The 1-wire solution has two Horizon units mounted on a Power Switch Radio Mount (PSRM). The 2-wire solution may be mounted on a PSRM, or have both Horizon units mounted on separate antenna systems.

When in standby mode, the radio transmitter is muted. If the Primary unit is active, then the transmitter on the Secondary unit is muted. If the Secondary unit is active, then the transmitter on the Primary unit is muted.

3.12.1 BNC Connector

The BNC connector on the side of the Horizon Compact serves a dual purpose. It can be configured as a source for field strength measurements during antenna alignment, or configured to provide a redundancy switch signal to a second Horizon Compact system mounted close by. For redundancy applications, ensure that the BNC connector is not configured for the alignment feature by using the CLI command ***set alignment off*** and press Enter.

When the Horizon system is configured for redundancy, a DC signal is presented at the BNC connector of the unit normally carrying traffic. Since the BNC connectors on both units are interconnected, the DC signal is passed to the stand-by unit. As long as the DC signal is present, then the stand-by radio is held in a hot stand-by state. When the DC signal is removed (as a result of the unit normally carrying traffic failing), then the stand-by radio becomes active, and takes over the traffic. After a redundancy switch, once the first system is able to return to carrying traffic, a manual switch is required, via a CLI command, to return the system to its original state.

The voltage level at the BNC port is 3.3 VDC. The current draw is less than one-half milliamp and based on standard coaxial cable specifications (for example 49 ohms per 1000 ft for RG-59), the loss is negligible for the coaxial cable and therefore there is no rational limit on coaxial cable length.

3.12.2 Primary and Secondary Horizon

Configuring redundancy requires that one of the Horizon units has to be configured as the “Primary” unit and the other as the “Secondary” unit. The terms “primary” and “secondary” relate solely to the internal functions of the Horizon units and have no relationship to which Horizon radio is in stand-by or which is carrying traffic. Either primary or secondary units may be active or in stand-by. The “primary” radio performs the redundancy controlling and switching functions. On power-up, the Horizon unit that is configured as the primary instructs the secondary Horizon unit to attempt to create a link with its peer at the far end. If successful, this link becomes the active link and the primary Horizon remains in a stand-by state unless the secondary unit link fails and thus causes the primary radio to take over the traffic.

3.12.3 How and When Protection Switching Occurs

Protection switching is triggered as a result of massive data loss caused by link outage, power failure, or hardware failure. Modem-to-modem communications occur constantly, whether or not Ethernet data is

being sent over the Horizon link. This continuous data stream is used as the trigger for Protection Switching activation. Therefore, it is able to detect both hardware failures as well as link failures. Switching times are in the order of 50 msec.

3.12.4 Recovery After Protection Switching

After a redundancy switch has occurred, return to the original path is achieved with a manual override. If, however, the path has been switched from previously active to stand-by, then, if a link failure or outage on the stand-by path occurs the data path will automatically switch back (reverting) to the previously active path, provided that the system parameters have been set to allow the switch back.

3.12.5 Forcing the Data Path to a Particular Link

It is possible to force the activity to follow a particular path. This option can be used during regular operation of the link, or it can be used as a trouble-shooting tool. The CLI command is ***set redundancy override [primary/secondary/manual/auto]***. Selecting "primary" will force the path onto the link being supported by the Horizon unit configured as the primary. Selecting "secondary" will force the path onto the link being supported by the Horizon unit configured as the secondary. In either case, activity will remain with the selected unit, regardless of path conditions, until the user issues another relevant command.

3.12.6 Redundancy CLI Commands

Redundancy Mode:

The redundancy mode is set for both the units at each end. Set the appropriate units as either primary or secondary and set the appropriate mode of 1-wire or 2-wire. This command is to be issued on all 4 units.
Command syntax: ***get/set redundancy mode [primary_hsb_1wire | secondary_hsb_1wire | primary_hsb_2wire | secondary_hsb_2wire| off]***

Note : (hsb = hot stand-by)

Redundancy Override

The options for redundancy override are primary, secondary, manual, auto, none. Selecting "primary" will force the Horizon unit configured as "primary" to carry the traffic and it will remain there. Traffic will not be switched to the stand-by link, even if the active link fails. Similarly, selecting "secondary" will force the Horizon unit configured as the secondary to carry the traffic and it will not switch away from that unit.

Selecting "manual" and "auto" has a different affect depending on if the systems are configured as 1-wire or 2-wire installations.

1-Wire configuration

"Auto" is not supported for the 1-wire mode. Selecting "auto" defaults to the "manual" behaviour as follows: On power-up, the Horizon unit that is configured as the primary unit instructs the secondary unit to attempt to establish a link with its peer at the far end. If successful, this link becomes the active link and the primary Horizon remains in stand-by. If the secondary unit cannot establish a link, then the system returns activity to the primary unit, where it remains, regardless as to if it can establish a viable link or not. The primary unit controls this operation.

2-Wire configuration

In the "manual" option, on power-up, whichever Horizon units (primary or secondary) can establish a link, they will take control and remain as the active link. If they cannot establish a link, then they give up control to the other unit and remain in stand-by unless manually switched.

Selecting "auto" will result in the activity toggling between the secondary and primary units in order to find a suitable link. If the secondary unit cannot establish a link then activity will switch to the primary unit. If the primary unit cannot establish a link, then activity will switch back to the

secondary then to primary while the system searches for a viable link. The system will continue "toggling" between primary and secondary until it finds a viable link.

Command syntax*:* ***get/set redundancy override [primary | secondary| manual | auto | none]***

Redundancy state switch

When the redundancy override is set to "manual" or "auto", you can toggle between both Horizon redundancy states by issuing the redundancy state switch command. There is only one choice, that being "on". Repeating the command gives the toggling action.

If this command is issued, then the active link will become the stand-by link, or vice-versa. For 1-wire configuration, this command must be issued on the primary unit, and only issued at one end of the link.

Command syntax: ***set redundancy state switch on***

Redundancy enet state switch

This option is more applicable to the 2-wire configuration. Enet state determines the action of the Ethernet port on the inactive unit, as seen on the Ethernet switch.

"On" means that the Ethernet Link will remain in the "on" state even if a failure occurs.

"Off" means that the Ethernet Link will turn "off" when a failure occurs, resulting in the Ethernet switch seeing the equivalent condition of the Ethernet cable being disconnected.

"Pulse" means that the Horizon Compact P1 Payload ports will "pulse" or "toggle" quickly from one port to the other in order to speed up the Ethernet switch switching algorithm. Both P1 Payload ports will pulse very rapidly and the switch will interpret this pulsing and react by accelerating its algorithm to determine the link over which to send the data traffic.

Command syntax: ***get/set redundancy secondary enet state [on | off | pulse]***

Redundancy link monitor parameters

The Horizon redundancy system needs to know how long a stand-by unit should wait when its active partner is beginning to fail, before it takes over the traffic. The redundancy link monitor parameters provide this information.

Command syntax: ***get/set redundancy link monitor parameters [values]***

Redundancy link switch parameters

When a system is in the process of switching from active to stand-by, the time that the system needs to wait, to confirm if the stand-by unit can establish a link, before switching, is provided by the redundancy link switch parameters.

Command syntax: ***get/set redundancy link switch parameters [values]***

Redundancy status

The status (active, stand-by, link up/down) of the primary and secondary Horizon units can be determined with this command.

Command syntax: ***get redundancy status***

Redundancy partner information

Information about the peer, or partner, Horizon can be obtained by issuing this command.

Command syntax: ***get redundancy partner information***

3.12.7 Two Wire Option Example

The “two wire” option is so named because two separate data feeds are required; one to each Horizon system. One Horizon system is configured as the primary and the other as the secondary. Management has to be via Port 2, so each Horizon will be configured for out-of-band management and have its Port 2 connected to the overlay management network.

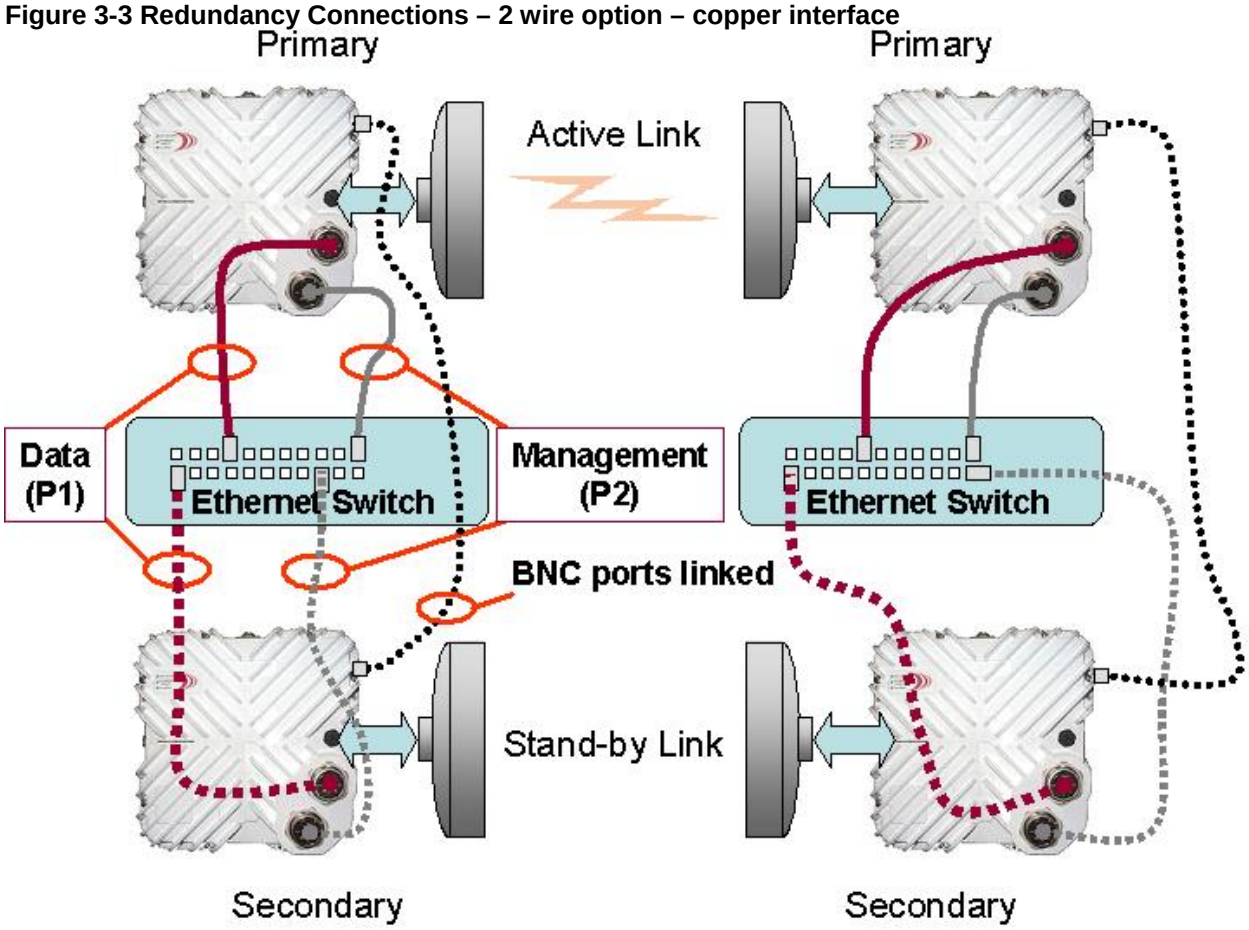
Data re-routing, between the Horizon systems, is dependant upon a connected Ethernet switch. Ethernet switch settings are used to reroute the traffic from one Horizon unit to the other, when a failure occurs. Protocols such as RSTP, LACP and routing protocols are able to determine that the Horizon units have switched between primary and secondary units, or vice-versa, and will reroute the data traffic through the active link.

In Omni Release 1.1 of Horizon Compact, the protection schemes result in an average of 50 msec switch time from active to standby link. The data traffic will revert to the previously active link if there is a failure on the currently active link or if the user intervenes.

The Horizon Compact system with copper interface is connected as shown in Figure 3-3. Each end of the link is connected the same way.

NOTE: For clarity, the PonE power adapter and surge arrestor have been omitted from the diagrams. Both the Port 1 and Port 2 Ethernet connections and the power feed via Port 1 must be protected from transients.

Figure 3-3 Redundancy Connections – 2 wire option – copper interface



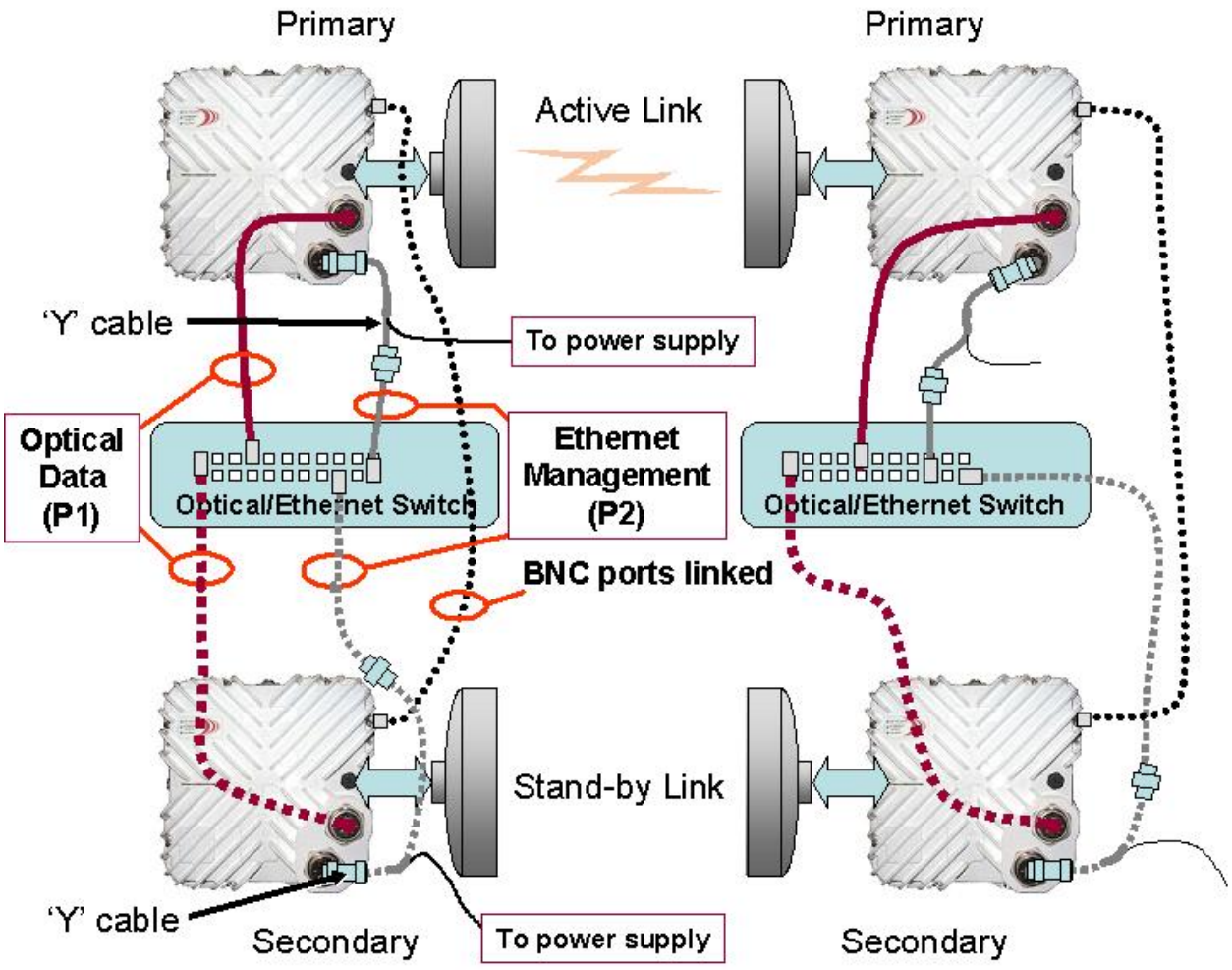
Data is connected via Port 1 (P1) of both units and management access is via port 2 (P2) of both units. Management is, therefore, out-of-band.

The Ethernet cable length must not be greater than 100 m.

The Horizon Compact system with optical interface is connected as shown in Figure 3-4. Each end of the link is connected the same way.

NOTE: For clarity, the Transtector surge arrestor has been omitted from the diagrams. Both the Port 2 Ethernet connections and the power feed via Port 2 must be protected from transients.

Figure 3-4 Redundancy Connections – 2 wire option – optical interface



The optical data feeds are connected to Port 1 (P1) of both the Primary and Secondary horizon units, and the optional out-of-band management is via Ethernet to Port 2 (P2) of both units. The Port 2 connection (weatherproof MIL type connector) is fed via a 'Y' cable that splits out the power supply feed to the Horizon and the optional management Ethernet feed (maximum length 100 m) using an in-line RJ-45 connector. Alternatively, the AirPair ODU composite power and Ethernet cable can be used for the Port 2 connection.

Procedure 3-18

Configuring 2 Wire Redundancy

Required Action	Steps
Configure all 4 units the same unless indicated otherwise	
login	Log in as a NOC user.
Confirm that alignment mode is OFF	Redundancy will not function if the alignment mode for the BNC connector is enabled. This must be disabled. Sequence: **set alignment off** press Enter The system responds: *System alignment is set to off.*
Network management	For 2-wire mode we need to configure all units for out-of-band management via port2. Sequence: **set network management interface port2** press Enter The system responds: *Network management interface is set to : port2*
Redundancy mode	This command sets the redundancy mode for either a primary or secondary unit, with either 1-wire or 2-wire hardware configuration. Since we are configuring a 2-wire system, use the following: ***FOR A PRIMARY UNIT-*** Sequence: **set redundancy mode primary_hsb_2wire** Note: hsb = hot stand-by The system responds: *System redundancy mode is set to : primary_hsb_2wire* ***FOR A SECONDARY UNIT-*** Sequence: **set redundancy mode secondary_hsb_2wire** The system responds: *System redundancy mode is set to : secondary_hsb_2wire*
Redundancy override	This command determines how the system will respond when a link failure occurs. In this example we will select the “auto” mode. Sequence: **set redundancy override auto** press Enter The system responds: *redundancy override mode is set to : auto*

Required Action	Steps
Redundancy secondary enet state	Enet state determines the action of the Ethernet port on the inactive unit, as seen by the Ethernet switch. The options are on, off or pulse. In this example we will use “pulse” to speed up the re-routing switch event. Sequence: **set redundancy secondary enet state pulse** press Enter The system responds: *redundancy secondary enet port1 state is set successfully*
Redundancy link monitor parameters	The Horizon redundancy system needs to know how long a stand-by unit should wait, when its active partner is failing, before it takes over the traffic. The parameters are different for 1-wire and 2-wire applications, with the primary and secondary units of a 2-wire application also having different values. The example parameter values shown below are recommended for effective switching and need to be configured at each end of the link. Sequence: **set redundancy link monitor parameters [Type index] [parameters]** Where **[Type index]** = 1 for 1-Wire Primary unit 3 for 2-Wire Primary unit 4 for 2-Wire Secondary unit and **[parameters]** are recommended values shown below ***FOR A PRIMARY UNIT-*** **set redundancy link monitor parameters** **3 2 10 4 4 10000 2000 2000 30 50** press Enter The system responds: *Link Monitor Values: 2 10 4 4 10000 2000 1000* ***FOR A SECONDARY UNIT-*** **set redundancy link monitor parameters** **4 2 10 4 4 10000 2000 2000 30 50** press Enter The system responds: *Link Monitor Values: 2 10 4 4 10000 2000 1000*

Required Action	Steps
Redundancy link switch parameters	When a system is in the process of switching from active to stand-by, the time that the system needs to wait, to confirm if the stand-by unit can establish a link, before switching, is provided by the redundancy link switch parameters. The parameters are different for 1-wire and 2-wire applications. The example parameter values shown below are recommended for effective switching and need to be configured at each end of the link. ***FOR PRIMARY AND SECONDARY UNITS-*** Sequence, with recommended values: **set redundancy link switch parameters** **900 300 80 600 300 80** press Enter The system responds: *Redundancy Link switch parameters values: 900 300 80 600 300 80*
Redundancy status	This command returns the current status of the redundancy system. Sequence: **get redundancy status** press Enter The system responds (Example): *redundancy mode :primary_hsb_2wire* *override mode :manual* *peer mode :secondary_hsb_2wire* *link is active on :secondary*
Redundancy partner information	This commands returns information about the Horizon redundancy partner. Sequence: **get redundancy partner information** press Enter The system responds (Example): *Partner's Information:* *MAC Address :00-07-58-00-A2-26* *IP Address :192.168.37.38* *Redundancy Mode :secondary_hsb_2wire* *Receiver RSL :-51.30 dBm* *System Mode :hc50_371_256qam* *Radio Band :fcc18_1_50* *Frequency Bank :txLow* *Frequency Index :C8*

Required Action	Steps
save mib	Saves the MIB to RAM. Perform this command to save setting changes to non-volatile memory. Sequence: **save mib** press Enter The system responds: MIB saved successfully.

3.12.8 Single Wire Option Example

Two Horizon Compact units are mounted on a Power Switch Radio Mount (PSRM) as shown in Figure 3-5. The PSRM supports system redundancy by connecting two Horizon units to a single antenna. Only one of the radios of the mounted systems may operate at any one time. Both systems have the identical polarity, either both vertically or both horizontally polarized. One system is configured as the Primary (normally carrying traffic) and the other as the Secondary (in stand-by).

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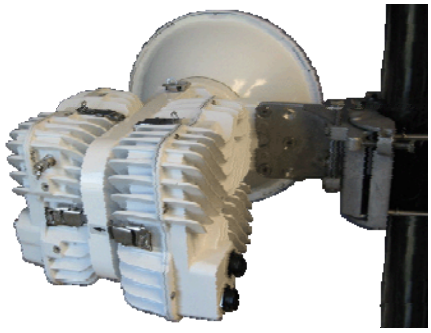
Figure 3-5 Power Switch Radio Mount



NOTE: When connecting the Horizon Compact units to the PSRM mount, be sure to identify and record the serial number of the unit connected to the PSRM Primary port and the unit connected to the PSRM Secondary port. When setting the Redundancy configuration in software, be sure to match the configured Primary unit with the unit physically connected to the PSRM primary port.

In this configuration (both copper and optical interfaces), management activity is via port 1 of the secondary Horizon. This means that the secondary unit must be configured for in-band (port1) management. Management of the primary unit is via the port 2 link, so management for the primary is technically out-of-band, so the primary unit has to be configured for out-of-band (port2) management.

All data traffic is fed to port 1 of the primary unit.

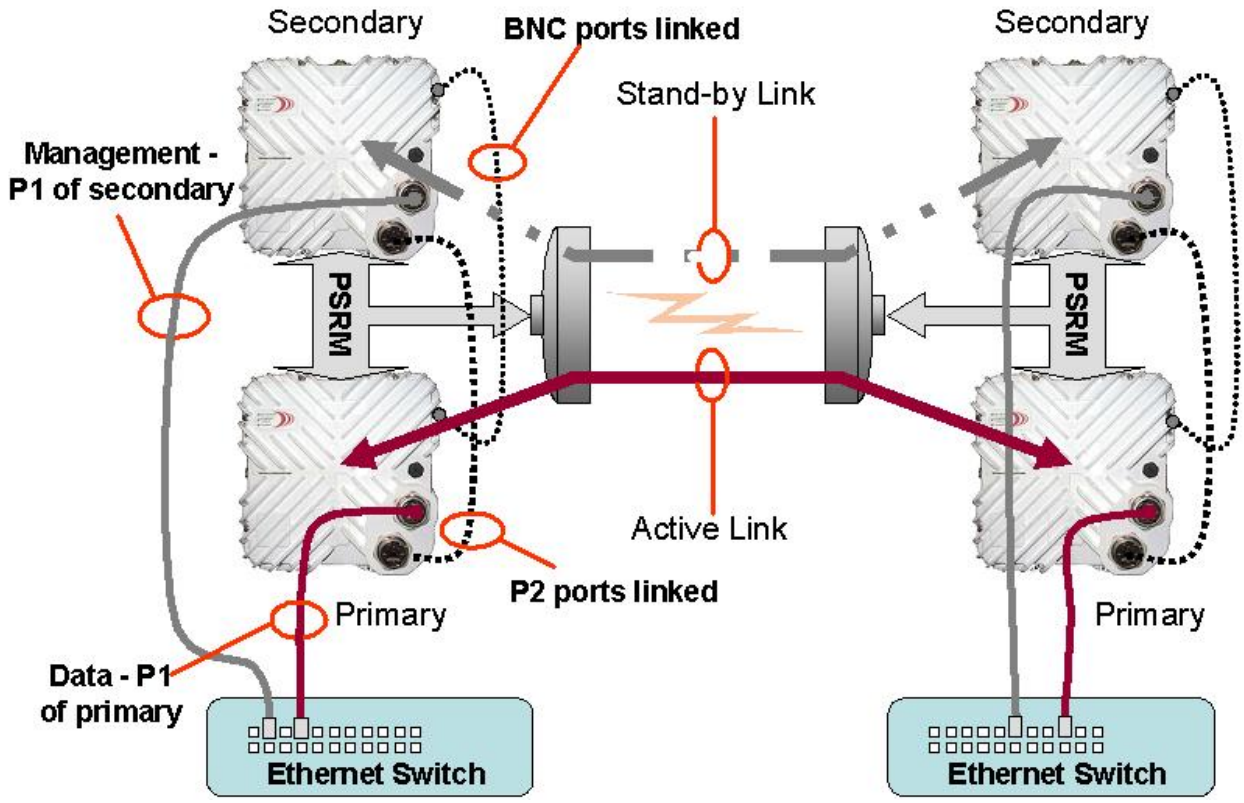
Switching from the active primary to the stand-by secondary is determined by the configuration of the Horizon Compact units and does not depend on connected Ethernet switches.

After a redundancy switch, once the primary system is able to return to carrying traffic, a manual switch is required to return the system to normal operation. This is only performed on the Primary unit. It has no effect on the Secondary unit.

The Horizon Compact system with copper interface is connected as shown in Figure 3-6. Each end of the link is connected the same way.

NOTE: For clarity, the PonE power adapter and surge arrestor have been omitted from the diagrams. Both the Port 1 and Port 2 Ethernet connections and the power feed via Port 1 must be protected from transients.

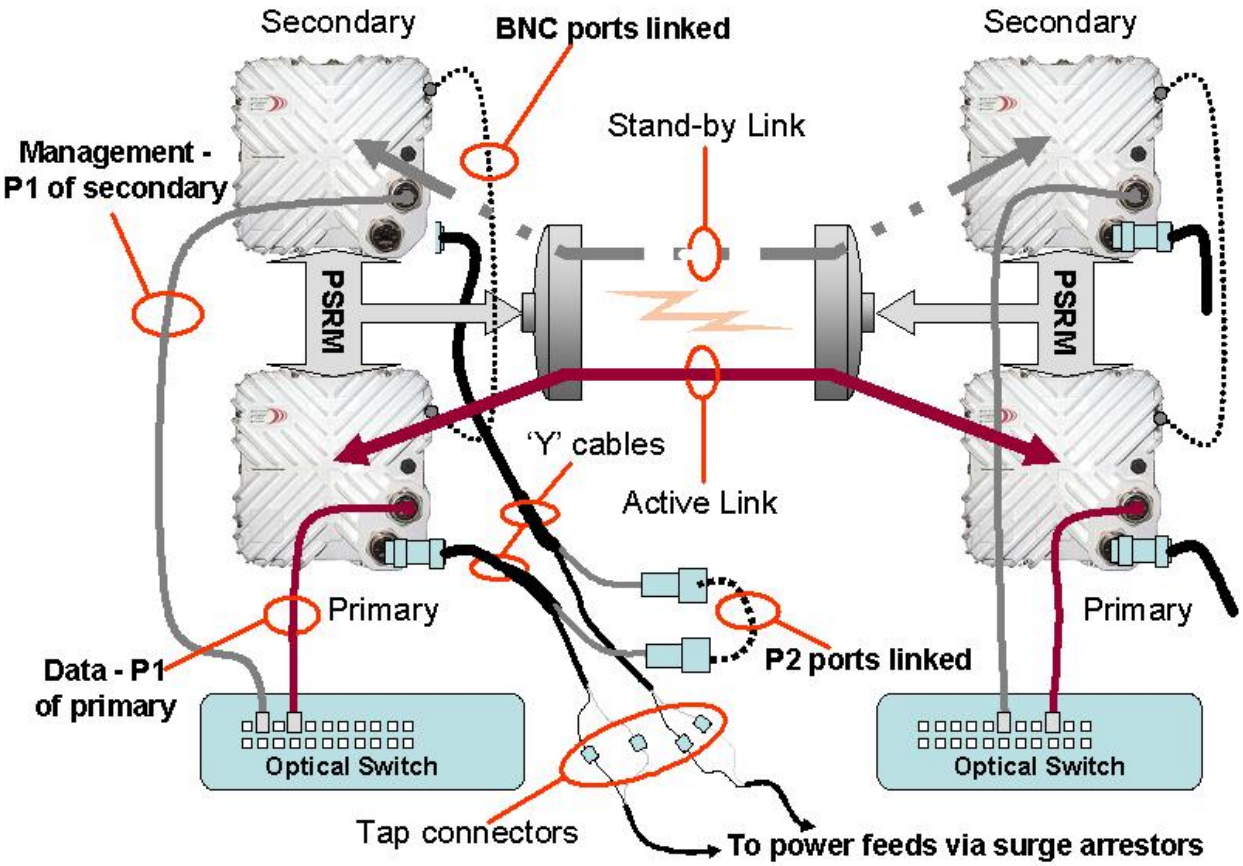
Figure 3-6 Redundancy Connections – single wire option – copper interface



The Horizon Compact with optical interface is connected as shown in Figure 3-7.

NOTE: For clarity, the Transtector surge arrestor has been omitted from the diagrams. Both the Port 2 Ethernet connections and the power feed via Port 2 must be protected from transients.

Figure 3-7 Redundancy Connections – single wire option – optical interface



The optical data feed is connected to Port 1 (P1) of the Primary unit and management is fed to Port 1 of the Secondary unit. The Port 2 (P2) connection (weatherproof MIL type connector) is fed via a 'Y' cable that splits out the power supply feed to the Horizon and an Ethernet cable using an in-line RJ-45 connector. The in-line RJ-45 connectors are linked, which interconnects Port 2 of both units. Power is fed to the 'Y' cable using Tap connectors to join to the power feed cable having a suitable gauge for the length of cable run employed.

Procedure 3-19

Configuring Single Wire Redundancy

Required Action	Steps
Configure all 4 units the same unless indicated otherwise	
login	Log in as a NOC user.
Confirm that alignment mode is OFF	Redundancy will not function if the alignment mode for the BNC connector is enabled. This must be disabled. Sequence: **set alignment mode off** press Enter The system responds: *Alignment mode is off*
Network management	For 1-wire mode we need to configure primary units for out-of-band management via port2 and secondary units for in-band management via port1 ***FOR A PRIMARY UNIT-*** Sequence: **set network management interface port2** press Enter The system responds: *Network management interface is set to : port2* ***FOR A SECONDARY UNIT-*** Sequence: **set network management interface port1** press Enter The system responds: *Network management interface is set to : port1*
Redundancy mode	This command sets the redundancy mode for either a primary or secondary unit, with either 1-wire or 2-wire hardware configuration. Since we are configuring a 1-wire system, use the following: ***FOR A PRIMARY UNIT-*** Sequence: **set redundancy mode primary_hsb_1wire** Note: hsb = hot stand-by The system responds: ***FOR A SECONDARY UNIT-*** Sequence: **set redundancy mode secondary_hsb_1wire** The system responds:

Required Action	Steps
Redundancy link monitor parameters	The Horizon redundancy system needs to know how long a stand-by unit should wait, when its active partner is failing, before it takes over the traffic. The parameters are different for 1-wire and 2-wire applications, with the primary and secondary units of a 2-wire application also having different values. The example parameter values shown below are recommended for effective switching and need to be configured at each end of the link. For 1-Wire applications only the primary horizon units have to be configured. ***FOR A PRIMARY UNIT ONLY-*** Sequence: **set redundancy link monitor parameters [Type index] [parameters]** Where **[Type index]** = 1 for 1-Wire Primary unit 3 for 2-Wire Primary unit 4 for 2-Wire Secondary unit and **[parameters]** are recommended values shown in the example below: Example **set redundancy link monitor parameters** **1 3 100 4 4 1000 500 500 100 50** press Enter The system responds: *Link Monitor Values: 3 100 4 4 1000 500 500 100 50*
Redundancy link switch parameters	When a system is in the process of switching from active to stand-by, the time that the system needs to wait, to confirm if the stand-by unit can establish a link, before switching, is provided by the redundancy link switch parameters. The parameters are different for 1-wire and 2-wire applications. The example parameter values shown below are recommended for effective switching and need to be configured at each end of the link. For 1-Wire applications only the primary horizon units have to be configured. ***FOR A PRIMARY UNIT ONLY-*** Sequence, with recommended values: **set redundancy link switch parameters** **900 900 70 600 600 70** press Enter The system responds: *Redundancy Link switch parameters values: 900 900 70 600 600 70*

Required Action	Steps
Redundancy override	***FOR A PRIMARY UNIT ONLY-*** This command determines how the system will respond when a link failure occurs. “manual” mode is recommended. Sequence: **set redundancy override manual** press Enter The system responds: *redundancy override mode is set to : manual*
Redundancy secondary enet state	Not applicable to 1-wire mode.
Redundancy status	This command returns the current status of the redundancy system. Sequence: **get redundancy status** press Enter The system responds (Example): *redundancy mode :primary_hsb_1wire* *override mode :manual* *peer mode :secondary_hsb_1wire* *link is active on :primary*
Redundancy partner information	This commands returns information about the Horizon redundancy partner. Sequence: **get redundancy partner information** press Enter The system responds (Example): *Partner's Information:* *MAC Address :00-07-58-00-A2-26* *IP Address :192.168.37.38* *Redundancy Mode :secondary_hsb_1wire* *Receiver RSL :-51.30 dBm* *System Mode :hc50_371_256qam* *Radio Band :fcc18_1_50* *Frequency Bank :txLow* *Frequency Index :C8*
Save mib	Saves the MIB to RAM. Perform this command to save setting changes to non-volatile memory. Sequence: **save mib** press Enter The system responds: *MIB saved successfully.*

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4.0 Horizon Compact Management

The Horizon Compact system can be fully managed locally or remotely. Horizon Compact supports Telnet access, SNMP management and a Web interface accessible through the IP network. The entire Command Line Interface (CLI) command set is available through Telnet. The entire list of system parameters is available through SNMP access. The Web interface provides access to system configuration and performance parameters.

Management traffic can be configured as in-band or out-of-band.

In-band management traffic is via Port 1. Out-of-band management traffic is via Port 2.

To configure the management interface use the following procedure :

Procedure 4-1
Configuring Network Management Interface

Required Action	Steps
login	Log in as the Super User.
set network management interface	sets the type of network management interface Sequence : **set network management interface [port1/port2/port2 extended]** press Enter Select **port1** for in-band management, **port2** for out-of-band management and **port2 extended** for out-of-band management of the far end Horizon Compact unit. The system responds: *Network management interface is set to : [port1/port2/port2 extended]*
save mib	Saves the MIB to RAM. Perform this command to save configuration changes to non-volatile memory. Sequence: **save mib** press Enter The system responds: *MIB saved successfully.*

4.1 Management through Port 1 (in-band)

Port 1 is always used to carry customer data traffic and operates at a rate of up to 400 Mbps, depending on system configuration, from the local Horizon Compact unit through to the far end Horizon Compact unit over the Radio Link.

When the network management interface is set to "port1" all management traffic must arrive on Port 1, or it will be ignored by the system. Configuration and management of the Horizon Compact system can be accomplished through a Telnet session, and although the Telnet session is intermixed with user traffic, the Telnet session occupies very little bandwidth (in the order of kbps) and therefore has almost no effect on user traffic throughput.

Management can also be performed via the Web interface (see Section 4.5 for more details) or via SNMP (See Section 5.1).

A Telnet session can be established through one Horizon Compact system, over the radio link to the far end Horizon Compact system. If Telnet management through Port 1 is not desirable, then two other options exist:

1. Creation of a management VLAN, through which Horizon Compact management traffic is routed. Management of the Horizon Compact system can be performed through a VLAN using 802.1Q VLAN tagging. Management through VLAN offers increased access controls. See Section 3.2.4 for configuration details.
2. Use of Port 2, which can be connected to a switch or router which does not inter-mix management traffic with user traffic.

If Port 2 is not being used (e.g. Port 1 in-band management being used), ensure that the vacant connector is sealed by fitting a weatherproof cap.

4.2 Management through Port 2 (out-of-band)

Port 2 is available for management purposes only. It does not carry customer data traffic. It has been designed to be used in conjunction with a management overlay network that is separate from the customer data network. The management overlay network is typically extended back to the Network Operations Center.

Port 2 supports management of the Horizon Compact system through Telnet sessions, SNMP (see Section 5.1) and the Web interface (see Section 4.5). When the network management interface is set to "port2", all management traffic must arrive on Port 2, otherwise it is ignored by the system. Customer data traffic continues to be carried over Port 1.

To access the far end Horizon Compact unit the management interface must be set to **port2 extended**.

When “**port2 extended**” is invoked, avoid having an Ethernet connection on Port 2 at the far end, otherwise a network loop may be created.

4.3 Telnet Access

Once correctly configured, the Horizon Compact is accessible through a Telnet session using Super User, NOC and Admin level user accounts. Refer to Appendix A for details of CLI commands. The Horizon Compact system can be completely configured, tested and managed through a Telnet session. The Telnet function is enabled by default but can be disabled within the Horizon Compact system.

Procedure 4-2
Configuring Telnet Access

Required Action	Steps
login	Log in as the Super User.
get telnet access	Returns the status of Telnet access (on by default) Sequence : **get telnet access** press Enter The system responds: *telnet access is [on/off]*
set telnet access	Enables or disables Telnet access. Sequence : **set telnet access [on/off]** press Enter The system responds: *telnet access is [on/off]*
save mib	Saves the MIB to RAM. Perform this command to save configuration changes to non-volatile memory. Sequence: **save mib** press Enter The system responds: *MIB saved successfully.*

4.4 Secure Shell Access Security

Telnet sessions over a network such as the Internet are not secure. User names and passwords, as well as commands and system responses, are transmitted in clear text during a Telnet session. A secure shell (SSH) protocol can be enabled in the Horizon Compact system to ensure that access to the units is restricted to authorized clients. Horizon Compact uses the Secure Shell SSH2 server programme to create the secure environment for Telnet sessions. SSH2 is a recognised industry standard, encrypting, security, programme. When enabled, SSH encrypts the entire Telnet session, including all usernames, passwords, commands and responses from the system. SSH also verifies that you are talking to the desired server by means of an authentication process using a “fingerprint”. The “fingerprint” is a unique identifier found only on the desired server.

A Secure Shell client programme needs to be installed on any computer which is to be used to manage a Horizon Compact system with SSH enabled. A free SSH client programme (PuTTY) is available on the Web.

Note that both SSH and Telnet can be enabled at the same time. To ensure security, once SSH has been enabled, disable Telnet.

Also note that the Web server must be enabled on the Horizon before SSH can be enabled.

4.4.1 Configuring Secure Shell (SSH)

Use the following procedure to manage the SSH feature of the Horizon Compact system.

Procedure 4-3
Configuring Secure Shell (SSH)

Required Action	Steps
login	Log in as the Super User.
get ssh server	Returns the status of the Secure Shell SSH2 server. Sequence : **get ssh server** press Enter The system responds: *ssh server is [on/off]*
set ssh server	Enables or disables the Secure Shell SSH2 server. Sequence : **set ssh server [on/off]** press Enter The system responds: *ssh server is [on/off]* ***Note:*** *The Web server must be ON before the SSH server can be enabled.* *A system reset is required before SSH will be invoked.*

Required Action	Steps
get ssh server fingerprint	Retrieves the fingerprint of the server Sequence : **get ssh server fingerprint** The system respond :
save mib	Saves the MIB to RAM. Perform this command to save setting changes to non-volatile memory. Sequence: **save mib** press Enter The system responds: *MIB saved successfully.*
Reset system	A system reset is required to activate this feature. Sequence **reset system** press Enter The system responds: *Are you sure you want to reset? Y(yes) or N(no)* press **Y** The system will proceed to reset. You will have to log on again to regain access.

4.5 Horizon Compact Web Interface

This section provides an overview of the Horizon Compact Web interface. To use the Horizon Compact Web-based interface, you need a PC with a Web browser (Internet Explorer 5.5 or higher, or Netscape 4.5 or higher) and IP access to the Horizon Compact system. For the PC requirements refer to the browser vendor documentation.

The Horizon Compact Web interface is disabled by default. Enable the Web interface on both systems by logging on using Telnet and issuing the CLI command ***set web server on*** press Enter.

4.5.1 Features

The following list describes the features of the Horizon Compact Web interface:

- Remote system availability - the Web interface can be used on any computer having IP access to the Horizon Compact system.
- Runs in a standard Web browser - the Web interface runs on Internet Explorer 5.5 or higher or Netscape 4.5 or 4.7
- Requires no local software - the Web interface runs in the browser. All necessary software is stored on the Horizon Compact system.
- Controlled access levels depending upon login type - Super User, NOC and Admin level functions are supported based upon login type.

- Password protected.
- SSL Web server - provides encryption for the Web session and verifies that the Web browser is indeed connecting to a Horizon Compact system.
- Near real-time view of the network - the auto-refresh capability allows real-time monitoring of the Horizon Compact link.

4.5.2 Connecting to the Horizon Compact Web Interface

You may connect to the system through an IP network, either from a location which is local to the Horizon Compact Ethernet connection, or through a remote connection which has IP access to the Horizon Compact system.

Notes:

User groups may be configured for mandatory use of HTTPS (SSL). If configured, those users (Super User, Noc, Admin) are required to access the Horizon Compact Web interface through SSL. Attempts to access the modem through standard HTTP will result in the user being locked to the login screen.

If HTTPS (SSL) access is not required for the user group, then those users may choose between standard HTTP and HTTPS (SSL) access, as both modes will work.

When the computer is configured and connected, perform the following procedure.

Procedure 4-4
Connecting to the Horizon Compact Web Interface

Perform this procedure to monitor RSL, EQ Stress and E_b/N_o (SNR) for the Horizon Compact system.

1. In the **Address** bar of the Internet Explorer or in the **Location** bar of Netscape, type the URL or IP address of the Horizon Compact System to be controlled. Press **Return**.
2. The system will reply with the login screen.
3. Type your user name (with Super User, NOC, or Admin rights) and password.
4. Press **OK**. The Horizon Compact's main Web page launches.
5. Bookmark the page for easy reference later.

A Web browser may be used to fully configure the Horizon Compact system, provided the IP address of the system is known (default value 192.168.10.100) and you log on as the default Super User. Refer to Volume 1 of this manual for logging on details and basic configuration.

The Horizon Compact Web interface follows standard Web browser conventions:

- A text box allows keyboard input for that parameter
- Drop-down boxes display the list of available options for that parameter.

Notes:

1. the following functions are not supported through the Web interface :
   - User account establishment and account management
   - Software upload and download, including backup and restore of system configuration and user accounts
   - Configure Horizon Compact Type
   - Ping
2. Configuration privileges correspond to the login level.

4.5.3 Exiting the Application

To exit the Horizon Compact Web interface application, close the Web browser window. Closing the window will cause the user to be logged out of the system.

4.5.4 Login

The login page appears whenever you connect to the Horizon Compact Web interface. The session will remain active for as long as your browser stays connected to the Horizon Compact. Due to security concerns, if the computer is unattended for any length of time then it is recommended you disconnect from the Horizon Compact Web interface by closing your browser window.

Horizon Compact units support multiple Web sessions. The number of simultaneous sessions is limited by the number of accounts at each authorization level. For example, since there is a maximum of five NOC accounts, then five different NOC users may simultaneously log in (see Table 4-1). Additionally, any one user account may establish multiple sessions on a single Horizon Compact modem. Therefore a single Super User, NOC, or Admin account may be used by more than one person to log in to the same Horizon Compact modem.

Table 4-1
Simultaneous logins for Web interface

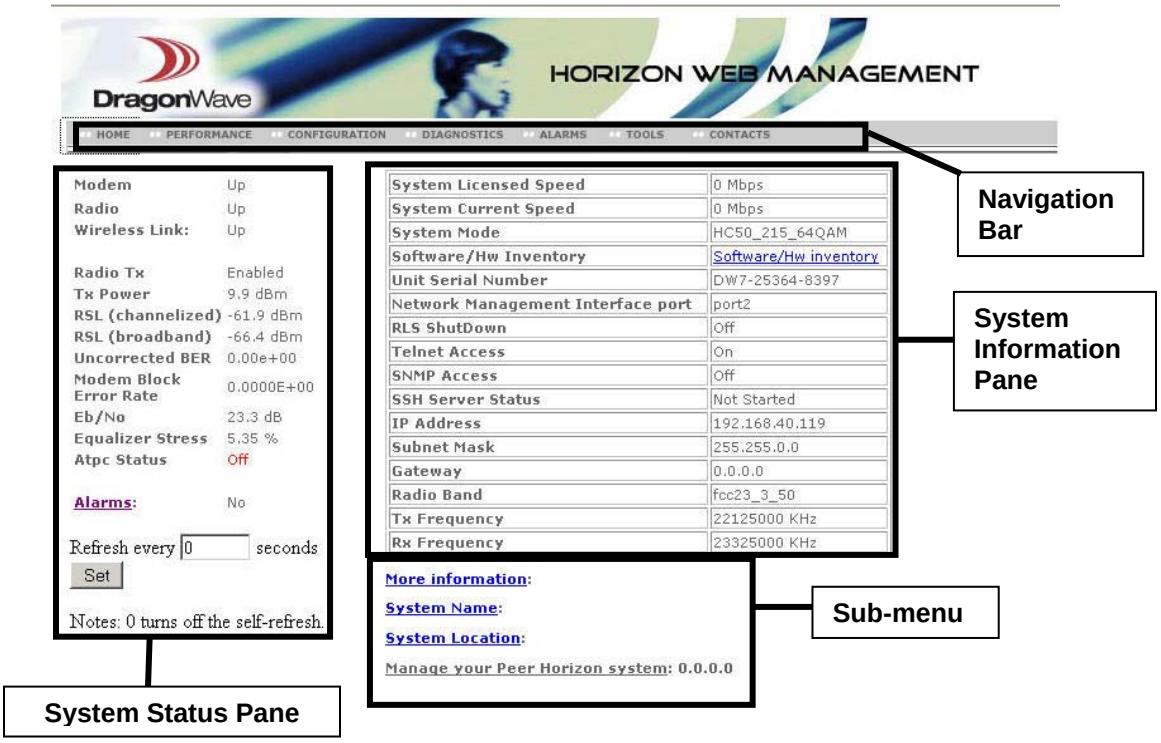
User Level	Number of Horizon Compact Accounts	Number of Simultaneous logins per Horizon Compact modem
Super User	1	1
NOC	5	5
Admin	50	50

Figure 4-1
Web Interface - Login Screen

4.5.5 Home Screen

The Horizon Compact Web interface runs in a standard browser. The Home Screen (window) is divided into three sections (panes). The navigation bar displays six menu options. The status pane on the left is used to monitor the system health and link performance. The system information pane on the right displays system parameters and links to more information.

Figure 4-2 Web Interface - Home Screen



Navigation Bar

Click on the navigation bar across the top of the page to navigate to different screens. Each menu option displays a single screen.

System Status Pane

The main screen displays system status in the left hand pane. The information can be continually refreshed. The default is no self-refresh (set to 0 seconds). Click on the “Set” button to manually refresh. The maximum refresh rate is 99999 seconds. The minimum refresh rate is 3 seconds. Setting the self-refresh rate also causes the Performance and Alarms screens to be refreshed at that rate.

System Information Pane

The system information pane contains information on the Horizon Compact type, management settings, IP address information, and frequency settings. This pane is not updated automatically. The user must refresh the screen either by using the browser's refresh button or by clicking on the Home button within the navigation bar in order to update the system information pane.

Sub-menu Options

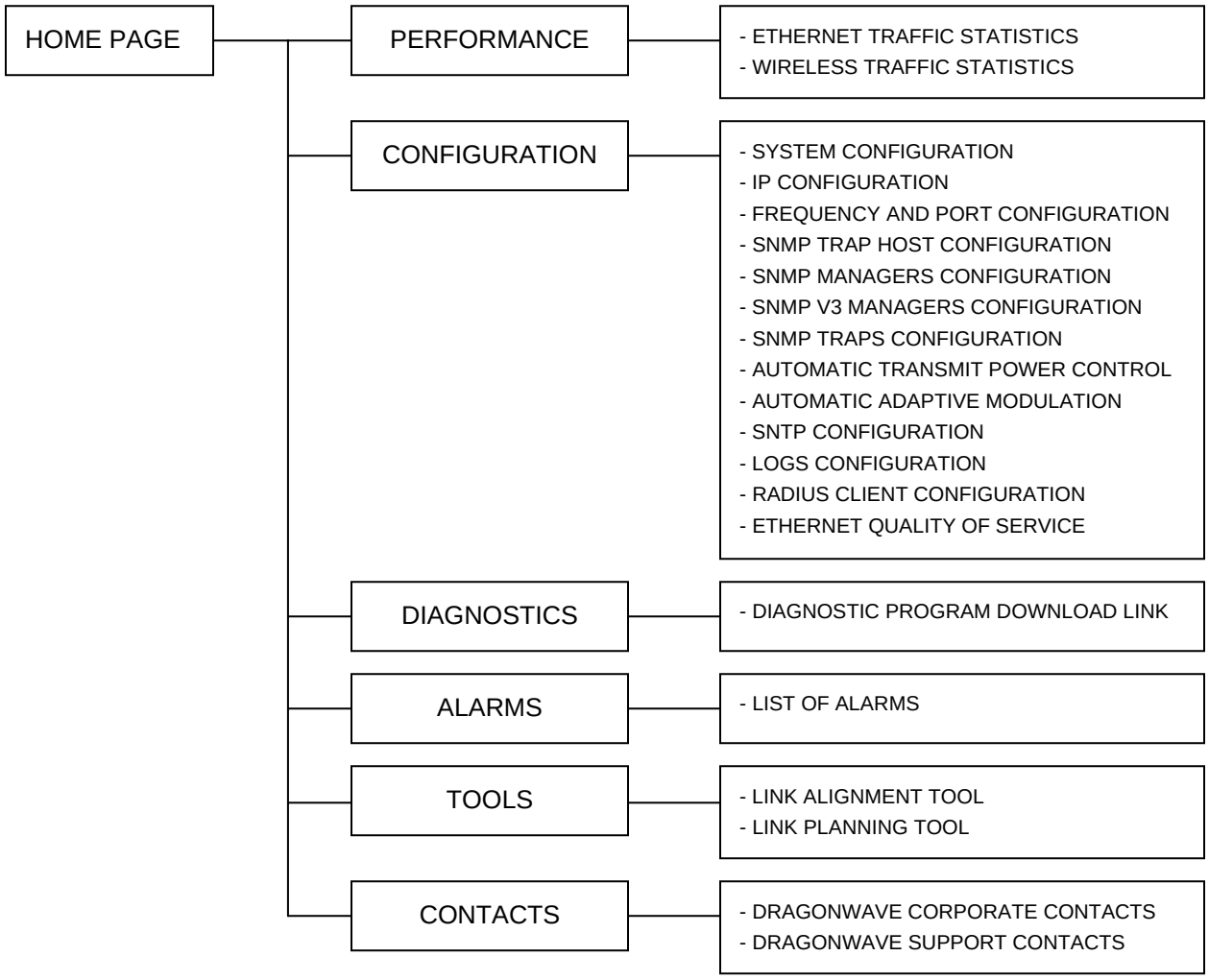
The main screen has four Sub-menu options :

- **More Information** - opens a window and displays a summary of the system configuration.
- **System Name** - link to the System Configuration page. If this field has been previously configured then the value is displayed
- **System Location** - link to the System Configuration page. If this field has been previously configured then the value is displayed
- **Manage your Peer Horizon system : [IP address]** - links to the login screen of the peer node (provided the peer node has had its IP address configured). This provides the user with a Web browser interface to each end of the Horizon Compact link.

4.5.6 Web Page Tree Diagram

Figure 4-3 maps the information available via the Web interface.

Figure 4-3 Web Interface – Tree Diagram



4.6 Horizon SSL Web Server

The Horizon Web server can be configured for Secure Sockets Layer (SSL). The Web server may be configured to operate in standard mode or in SSL mode. Horizon's SSL Web server is HTTP 1.0/1.1 compliant, features full support of HTML 2.0, 3.2, 4.0 and supports SSL 3.0.

Secure Sockets Layer, SSL, is the standard security technology for creating an encrypted link between a Web server and a browser. This link ensures that all data passed between the Web server and browser, remain private and integral. In order to be able to generate an SSL link, a Web server requires an SSL Certificate.

In order to invoke SSL on the Horizon Web server, an SSL certificate must be generated on the Horizon system. Horizon uses an embedded SSL Web server from Allegro Software Development Corporation. Once generated, the certificate may be held as a private certificate or it may be registered with a Trusted Certificate Authority such as:

- Allegro Software Development Corporation
- Microsoft Root Authority
- Thawte Server
- GTE Cybertrust Root
- VeriSign RSA Secure Server

SSL access can be enabled on a per-user group basis. SSL access can be invoked for the Super User, for all NOC accounts, for all Admin accounts, or any combination of the three. Once SSL access has been enabled for the user group then all members of that user group must use SSL to connect to the Horizon Web browser. Even if SSL access is not required for the user group, those users may access the Horizon Web browser through HTTPS (SSL) as a security measure.

4.6.1 What is SSL?

SSL stands for Secure Sockets Layer. The SSL protocol, developed by Netscape, is supported by all popular Web browsers such as Internet Explorer, Netscape, AOL and Opera. An SSL certificate, issued by a Certification Authority (CA), must be installed on the Web server in order for SSL to work. SSL can then be used to encrypt the data transmitted (secure SSL transactions) between a browser and Web server. Browsers indicate an SSL secured session is active by changing the URL from http to https and by displaying a small padlock in the bottom toolbar.

SSL works as follows:

1. A browser requests a secure page (usually through the https:// format within the URL).
2. The Web server sends its public key with its certificate.
3. The browser checks that the certificate was issued by a trusted party (usually a trusted root Certificate Authority), that the certificate is still valid and that the certificate is related to the site contacted. The browser keeps a list of trusted Certificate Authorities. New CA's may be added to the browser by the user.
4. The browser then uses the public key, to encrypt a random symmetric encryption key and sends it to the server with the encrypted URL required as well as other encrypted http data.
5. The Web server decrypts the symmetric encryption key using its private key and uses the symmetric key to decrypt the URL and http data.
6. The Web server sends back the requested html document and http data encrypted with the symmetric key.
7. The browser decrypts the http data and html document using the symmetric key and displays the information.

4.6.2 Generating a Certificate on the Horizon Compact

In order to generate an SSL certificate on the Horizon Compact, the user must be logged in as the Super User. The SSL certificate is tied to the Horizon Compact's IP address. If the IP address is changed, then the SSL certificate should be regenerated. Otherwise the browser SSL session will allow access but it will report that the certificate is invalid. In this situation, it is the browser user's responsibility to verify that the proper Horizon Compact is being accessed and that the invalid certificate is due to an IP address change.

Procedure 4-5
Generate SSL Certificate on the Horizon Compact

Perform this procedure to generate an SSL certificate on the Horizon Compact.

Note: To perform this procedure, you must have Super User rights.

Required Action	Steps
login	Log in as the Super User.
get ssl certificate status	Displays the status of the modem's SSL certificate. Sequence: **get ssl certificate status** press Enter The system responds with one of the following: *No SSL certificate has been created yet.* *Present but not linked to ip address.* *SSL certificate is valid.*
create ssl certificate	Creates an SSL certificate on the Horizon system. Once created, users may access the Horizon system Web interface through HTTPS (SSL). The SSL certificate is linked to the Horizon IP address. If the Horizon IP address is changed, then the certificate should be regenerated. Sequence: **create ssl certificate** press Enter The system responds: *This may take 10 minutes or longer if the system is busy. Do you want to continue? Enter Y(Yes) or N(No) :**y*** *Please wait...The security data has been successfully created.*

Required Action	Steps
get ssl certificate status	Perform this step to verify the certificate is active. Displays the status of the modem's SSL certificate. Sequence: **get ssl certificate status** press Enter The system responds with one of the following: *No SSL certificate has been created yet.* *Present but not linked to ip address.* *SSL certificate is valid.*
save mib	Saves the MIB to RAM. Perform this command to save changes to non-volatile memory. Sequence: **save mib** press Enter The system responds: *MIB saved successfully.*

This concludes the steps to generate an SSL certificate on the Horizon Compact using the CLI manager.

4.6.3 Installing Certificates on Your Web Browser

Browsers keep a list of trusted Certificate Authorities (CA) in order to verify SSL certificates. A default list of CA's is included with the browser software. New CA's can be added to the browser by the user.

Since the Allegro Software Development Corporation certificate does not commonly appear in a browser's list of authorities, you will need to install it yourself. You must first verify that it has a valid thumbprint or fingerprint. Once you have installed the Allegro certificate in your browser's database for trusted root authorities, you can securely communicate with devices running the Horizon SSL server.

Please refer to you Web browser's documentation for instructions on installation of certificates on your particular browser.

These instructions are provided as an example as to how to install the certificate in Internet Explorer versions 5.5 and 6. Earlier versions of Internet Explorer may work as well.

Procedure 4-6
Install SSL Certificates on Your Web Browser

Perform this procedure to install the Allegro SSL certificate on your Web browser.

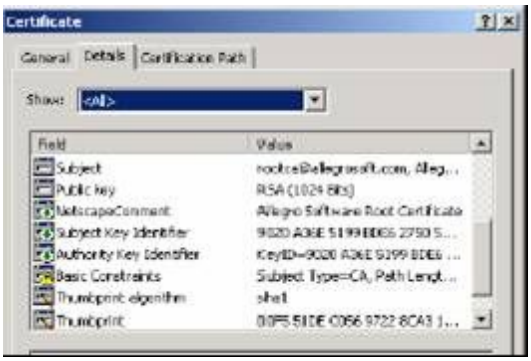
1. Download the CA certificate from the Allegro certificate site by issuing the following http request:
   http://www.allegrosoft.com/security/AsdcRoot.cer

2. Click Open to open the file from its current location:

3. When the following Certificate window appears, click the Details tab.

Certificate
General
Details
Certification Path
Certificate Information
This CA Root certificate is not trusted. To enable trust, install this certificate in the Trusted Root Certification Authorities store.
Issued to: Allegro Root CA
Issued by: Allegro Root CA
Valid from 5/13/2002 to 5/13/2032
Install Certificate...
OK

4. Scroll down to the Thumbprint line as shown:



5. Click on the Thumbprint line and verify that the thumbprint exactly matches the following line:

   00F5 51DE C056 9722 8CA3 1AAA 3D7C 7A15 D806 66D6

   Note: The thumbprint must match EXACTLY. If the thumbprint is anything else, the certificate is not valid.

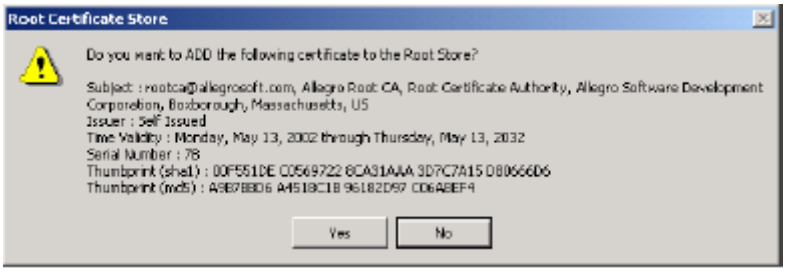
6. Click on the General tab then click Install Certificate to install the certificate. The Certificate Import Manager Wizard should appear.

7. Click Next to display the dialog box to select a certificate store. This should default to Automatically select the certificate store based on the type of certificate, as in the following figure.

Certificate Import Wizard
Certificate Store
Certificate stores are system areas where certificates are kept.
Windows can automatically select a certificate store, or you can specify a location for
Automatically select the certificate store based on the type of certificate
Place all certificates in the following store
Browse...

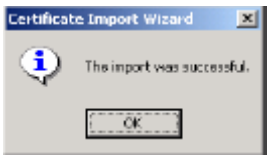
8. Click Next to accept the wizard's automatic selection of the certificate store. The following window should appear.

9. Click Finish. The wizard displays certificate details again.

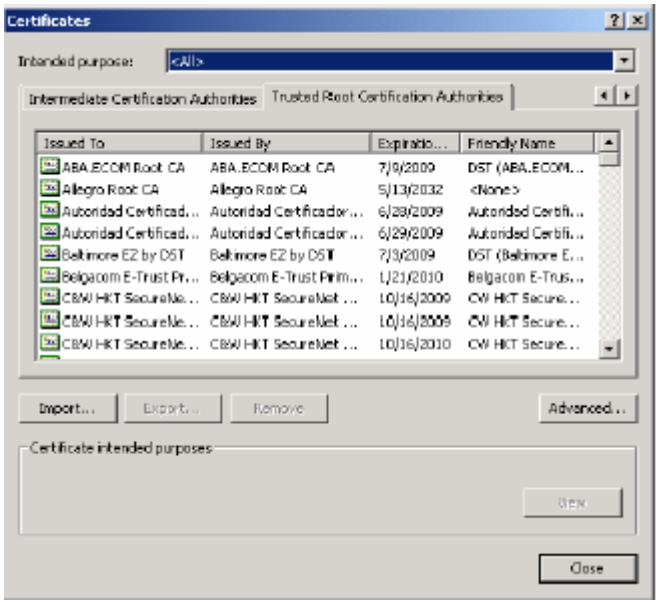

Root Certificate Store
Do you want to ADD the following certificate to the Root Store?
Subject : rootca@allegrosoft.com, Allegro Root CA, Root Certificate Authority, Allegro Software Development Corporation, Boxborough, Massachusetts, US
Issuer : Self Issued
Time Validity : Monday, May 13, 2002 through Thursday, May 13, 2032
Serial Number : 78
Thumbprint (sha1) : 00F551DE C0569722 8CA31AAA 3D7C7A15 D80666D6
Thumbprint (md5) : A9B7BBD6 A4518C1B 96182D97 CD6ABEF4
Yes
No

10. Verify again that the thumbprint is correct, then click Yes. You should see the sha-1 thumbprint confirmation shown below:

    00F551DE C0569722 8CA31AAA 3D7C7A15 D80666D6



11. Verify that the certificate is in the correct certificate store. Choose Tools, Internet Options, Content, Certificates. Then click the Trusted Root Certification Authorities tab, and verify that the certificate is listed.



At this point, you have verified that the Allegro certificate has been installed in the list of trusted certificate authorities. Your browser should now silently accept the HTTPS communication being offered by the Horizon Secure server.

This concludes the steps to install SSL certificates on your Web browser.

4.6.4 Enabling SSL per User Group

Web interface access for each user group may be configured so that SSL use is mandatory. If the use of SSL is not mandatory for a user group then that group can choose between standard HTTP access and HTTPS (SSL) access. For example, SSL may be made mandatory for all Noc and Admin level users, but not required for the Super User.

Procedure 4-7
Configure Mandatory SSL Access for Each User Group

Perform this procedure to configure mandatory SSL access to the Horizon modem for each user group.

Note: To perform this procedure, you must have Super User rights.

Required Action	Steps
login	Log in as the Super User.
get http secure access status	Displays the status of the user group's mandatory SSL access to the Horizon's Web interface. If the secure access is not required then users may access the Web interface both through standard HTTP and through HTTPS (SSL). Sequence: **get http secure access [user group]** press Enter where **[user group]** is one of: Super, Noc, Admin Note: **[user group]** is case sensitive. The system responds with one of the following: *The HTTP Secure access for [user group] users is [required/not required]* Example: *The HTTP Secure access for Noc users is required.*
set http secure access	Sets the SSL access to mandatory for the selected user group. Once set, the user group must access the Horizon Web interface using HTTPS (SSL). Standard Web access through HTTP will be restricted for that user group. Sequence: **set http secure access [user group] [on/off]** press Enter The system responds: *The HTTP secure access is set successfully.*

Required Action	Steps
save mib	Saves the MIB to RAM. Perform this command save setting changes to non-volatile memory. Sequence: **save mib** press Enter The system responds: *MIB saved successfully.*

This concludes the steps to configure mandatory SSL access to the Horizon Compact for each user group.

4.7 Event and Performance Logs

The Horizon Compact system supports two logs, the Events Log and the Performance Log. Each can be used to trace the behaviour of the system over time.

The Events Log is invoked or disabled by issuing the CLI command **set logging [on/off].** This log records alarm and reset events. Approximately 17,500 events can be captured by the Events log. Once the log is full the oldest entries are overwritten. See Procedure 4-8 for more details.

Issuing the CLI command **set performance logging [on/off]** enables or disables the Performance Log. This log collects system performance information at time intervals that are configured using the CLI command **set performance log interval [hh:mm:ss].** See Procedure 4-9 and Table 4-2 for more details.

Procedure 4-8
Events Log

Required Action	Steps
login	Log in as a NOC account
get logging	This command returns the status of the events log Sequence : **get logging** The system responds : *Logging has been :[enabled/disabled.]*

Required Action	Steps
get log entries	This command lists all events entries in the log since the log was enabled, or after it was last cleared. Ctrl-c aborts the listing. Sequence : **get log entries** The system responds : *Start of log ...* *0 10/07/2005 11:31:36 0 225017 477 W Demodulator lost synchronization* *0 10/07/2005 11:31:36 0 225016 476 W Link is down* *0 10/07/2005 11:31:36 0 225015 475 I cold start* *0 10/07/2005 11:31:36 0 225014 474 W auto negotiation duplex mismatch* *0 01/01/1970 00:00:11 0 225013 473 I Initialized Radio Manager* *0 01/01/1970 00:00:02 0 225012 472 I Flash Log is initialized* *<<<<Press any key to continue.....>>>>* *End of log.*
set logging	This command enables and disables events logging Sequence : **set logging [on/off]** The system responds : *Logging is :[on/off]*
save log	Saves the events log to a specified ftp server. Sequence : **save log ftp:[mylogfile]** Note: The maximum system log file size for ftp to a server holds about 1200 events (100KB). If more than 1200 events are stored on the system, then multiple files will be created and named as "mylogfile1", "mylogfile2" etc. The system responds (example): *Enter the IP address of FTP server followed by 'Enter' Key :[ip address]* *220 ProFTPD 1.2.5 Server (Dragonwave FTP Site) [support.dragonwaveinc.com]* *UserName :username* *331 Password required for username.* *Password :******* *230 User username logged in.* *Copy log entries to a file? Enter Y(yes) or N (no):y* *Trying to copy the data to mylogfile File. Please wait for a while.* *200 PORT command successful.* *150 Opening ASCII mode data connection for mylogfile.* *226 Transfer complete.* *Data successfully transferred to specified file. 221 Goodbye.*

Required Action	Steps
erase log	Removes all entries from the events log Sequence : **erase log** The system responds : *Erased log succcessfully.*

Procedure 4-9
Performance Log

Required Action	Steps
login using NOC account	Log in as a NOC account
get performance logging	Returns the status of performance logging Sequence : **get performance logging** The system responds : *Performance Logging has been :[enabled/disabled.]*
set performance logging	Allows you to enable or disable performance logging Sequence : **set performance logging [on/off]** The system responds : *Performance Logging is :[on/off]*
set performance log interval	Sets the time interval between performance log updates Sequence : **set performance log interval hh:mm:ss** Where **hh** is in hours, **mm** is in minutes and **ss** is in seconds. Note that the maximum interval allowed is 24 hours and the minimum is 15 seconds. The default setting is 15 minutes. See Table 4-2 for log durations for different intervals. The system responds : *The performance logging interval is set to: hh:mm:ss*

Required Action	Steps
get performance log	This command lists all performance entries in the log since the log was enabled, or after it was last cleared. Ctrl-c aborts the listing. Sequence : **get performance log** The system responds : *Start of Performance log ...* *SNR Eb/No RSL Temp Avg.BW PeakBW* *1 06/21/2007 13:15:09 0 526172 I 8.71 6.08 -44.88 30.5 68 85* *1 06/21/2007 12:29:56 0 526171 I 8.32 5.69 -44.75 30.6 66 90* *.* *End of Performance log.*
erase performance log	Erases the performance log Sequence : **erase performance log** The system responds : *Erased log successfully.*

Table 4-2 Performance Log Durations

Between 6000 and 8000 entries can be logged before the Performance Log memory is full. Once the memory is full, new entries will overwrite the oldest entries. The following table assumes that an average of 7000 entries will occur before memory overflow. If the memory accepts more entries, then the log duration before overflow will be extended.

Logging Interval	Log Duration
15 secs (minimum)	~ 29 hours
1 minute	~ 116 hours (~ 4.8 days)
15 minutes (default)	~ 73 days (~ 2.4 months)
1 hour	~ 292 days (~ 9.7 months)
24 hours (maximum)	7000 days (~ 19.2 years)

4.8 Radio Loopback

Horizon provides a radio loopback facility for analysis of transmit or receive path issues. Invoking a radio loopback is service affecting and will stop all data transfer. There are two options:

- Straight radio loopback - Ethernet traffic is not looped back to the network, Ethernet traffic is discarded and the RF portion of the Horizon unit is placed in loopback (see **Error! Reference source not found.**).
- Radio loopback plus network loopback – Ethernet traffic and the radio are placed in loopback

During the loopback, if the modem transmitter loss of sync alarm is not active, then both the transmitter and receiver of the Horizon unit under test are functioning correctly. A user configurable time limit can be applied to the loopback feature (default is 30 seconds). Once the time limit has expired the loopback will be automatically removed. Note that the far end transmitter should be muted when analysing the near end system using the radio loopback feature.

Procedure 4-10
Radio Loopback

Required Action	Steps
login using NOC account	Log in as a NOC account
get radio loopback	Returns the status of the radio loopback feature. Sequence: **get radio loopback** The system responds: *radio loopback is [on/off][time][network]*
set radio loopback	Enables and disables the radio loopback option. This feature allows the radio transmitter and receiver system to be tested. In one option the data signal is dropped and the radio signal alone is looped back. In the second option, the data as well as the radio signal is looped back. When in loopback, if no loss of synch alarm is raised, then this indicates that the radio transmit and receive portions of the system are working correctly. Note that this command is service affecting. The default time limit before the loopback is automatically removed is set to 30 seconds. Setting the time parameter to zero (0) maintains the loopback in place indefinitely, until it is turned off. Sequence : **set radio loopback [on/off] [time][network]** press Enter Where **time** is in seconds Option 1 **set radio loopback on** press Enter Radio loopback only with default time limit s**et radio loopback on 45 network** press Enter Radio and network loopback initiated with a timeout period of 45 seconds The system responds (Example) : *This may affect user traffic. Continue? Enter Y (Yes) or N (No)* ***Y*** *Radio loopback is on 45 network* **NOTE: setting the time to zero (0) will maintain the loopback condition on indefinitely. To stop the loopback, issue the following command:** **set loopback off** press Enter

5.0 Network Management of Horizon Compact

This section describes how to use network management to manage the Horizon Compact units.

5.1 Simple Network Management Protocol (SNMP)

Simple Network Management Protocol (SNMP) is an application-layer protocol used to exchange management information between network devices. Network management systems contain two primary elements: a manager and an agent. The manager resides on a Network Management Station (NMS). The NMS is a console through which the network administrator performs network management functions. Agents reside on the network devices such as bridges, hubs, routers, or network servers. The Horizon Compact system is a network device that contains an agent.

The SNMP manager uses Management Information Bases (MIBs). MIBs are a collection of definitions of the properties for the managed objects. Every managed device keeps a database of values for each definition written in the MIB. There are several standard MIBs provided in each NMS software package. These MIBs are common parameters for network devices such as unit health and IP traffic statistics. Each manufacturer typically provides an Enterprise MIB. The Enterprise MIB is a collection of definitions that address the particular aspects of the manufacturer's product. These Enterprise MIBs must be loaded onto the NMS, in other words, they must placed in the MIB "database" directory and enabled, in order for the NMS to access the parameters.

SNMP includes a limited set of management commands and responses. The management system issues Get and Set commands and the agent sends a response message in return. The Get command reads a parameter, and the Set command will configure, or assign a value to, a parameter. The managed agent also sends an event notification, called a *trap,* to the management system to identify the occurrence of conditions such as thresholds that have been exceeded.

Each SMNP managed object belongs to a community, or group. The Network Management Station may belong to multiple communities. The community string must be set in the agent device in order for the NMS to access the device.

5.1.1 Supported SNMP Versions

DragonWave Horizon Compact systems support three versions of SNMP.

- Version 1 (SNMP v1) is the initial implementation of SNMP.
- Version 2 (SNMPv2c) is the second release of SNMP, which has additions and enhancements to data types, counter size and protocol operations.
- Version 3 (SNMPv3) is the most recent version of SNMP. The functionality of SNMPv1 and SNMPv2c remain intact, but SNMPv3 has significant enhancements to administration and security.

SNMPv3 is an interoperable standards-based protocol that provides secure access to devices by authenticating and encrypting packets over the network. The security features provided in SNMPv3 are as follows:

- Message integrity
- Authentication
- Encryption

Procedure **5-1**
Setting up SNMP

Perform this procedure to set up SNMP for the Horizon Compact system.

Required Action	Steps
login	Log in as a NOC account for SNMP v1 and v2c, or Super user for SNMP v1, v2c and v3
set snmp access mode [v1/v2c/v3/off]	Selects a SNMP access mode. The default mode is SNMP mode v1. Sequence: **set snmp access mode [v1/v2c/v3/off]** press Enter The system responds: *SNMP Mode: [v1 | v2c | v3 | off]*
set snmp set request [on/off]	Sets the SNMP access mode to on. This allows SNMP 'set' requests. Sequence: **set snmp set request [on/off]** press Enter The system responds: *SNMP Set Requests are [on/off].*
get snmp set request	Displays SNMP requests state. Displays if SNMP 'set' requests are enabled. The default state is off. Sequence: **get snmp set requests** press Enter The system responds: *SNMP Set Requests are [on | off].*

Required Action	Steps
FOR SNMP v1 or v2c ONLY	
get snmp managers	Displays a list of managers that can access the system via SNMP v1 and v2c only. Sequence: **get snmp managers** press Enter The system responds: *Mgr # IpAddress CommunityString* *1 192.168.1.133 example text1* *2 192.168.1.100 example text2* If there are no managers specified, the system responds: *No managers configured for the system.*
set snmp manager [mgr#] [ip address] [enable/disable] [community string]	Specifies the SNMP managers to allow access to the system, v1 and v2c only. Sequence: **set snmp manager [mgr#] [ip address] [enable/disable] [community string]** press Enter The system responds: *Mgr# IpAddress Status CommunityString* *1 192.7.1.1 disabled public* *2 0.0.0.0 disabled public* *3 0.0.0.0 disabled public* *4 0.0.0.0 disabled public* *5 0.0.0.0 disabled public* *6 any disabled public* Notes: 1. Only maximum of 5 managers are allowed. If all the managers are filled in, remove 1 manager by overwriting the particular index. 2. By setting the IP address of last index to 'any' and 'enable', anybody can have access to the system via SNMP**.**

Required Action	Steps
FOR SNMPv3 ONLY	

set snmpv3 manager *{1..5}*
 	
This command requires the following prompts to be answered.
 	
user *username*
 	
securityLevel
[noAuthNoPriv
authNoPriv | authPriv]
 	
[**auth** {**md5** | **sha | none**} *auth-password*]
 	
[**priv** {**DES | none**}
priv-password]
	This specifies an snmpv3 external user.
	
	There may be up to 5 external SNMP managers configured in the system. Each user should have unique name. The default security level for the system is noAuthNoPriv.
	
	The user is prompted with the current value for each option. User may choose to keep or modify this entry by selecting y\n. For each prompt, available options are shown.
	
	Examples:
	
	`->set snmpv3 manager`
	`Enter the entry number to modify [1-5]: 1`
	
	`Current user Name for Entry [1] is [ ]`
	`Do you accept this user name? [y|n]n`
	`Enter Snmp V3 UserName :user1`
	
	`New user Name for Entry [1] is set to [user1]`
	
	`Current Authentication Protocol for Entry [1] is [NoAuth]`
	`Do you accept this value? [y|n]n`
	`Enter authentication protocol [0=NoAuth | 1=MD5 | 2=SHA]: 1`
	
	`New authtentication protocol for Entry [1] is set to [MD5]`
	
	`Current authentication password for entry [1] is [-]`
	`Do you accept this value? [y|n]n`
	`Enter authentication password: authpass`
	
	`New authtentication password for Entry [1] is set to [authpass]`
	
	`Current privacy Protocol for Entry [1] is [NoPriv]`
	`Do you accept this value? [y|n]n`
	`Enter privacy protocol [0=NoPriv | 1=DES ]: 1`
	
	`New privacy protocol for Entry [1] is set to [DES]`

Required Action	Steps
	Current privacy Password for Entry [1] is [-] Do you accept this value? [y|n]n Enter privacy password: privpass New privacy password for Entry [1] is set to [privpass] Current status for Entry [1] is [Disabled] Do you accept this value? [y|n]n Do want to activate this entry? [0=disable| 1=enable]: 1 New activate option for Entry [1] is set to [Enabled] index userName authProt authPass privProt privPass status ========== 1 user1 MD5 authpass DES privpass enabled 2 NoAuth - NoPriv - disabled 3 NoAuth - NoPriv - disabled 4 NoAuth - NoPriv - disabled 5 NoAuth - NoPriv - disabled Note: 1.Only maximum of 5 managers are allowed. If all the managers are filled in, remove 1 manager by overwriting the particular index.
get snmpv3 managers	Displays a list of configured SNMPv3 managers. **get snmpv3 managers** press Enter The system responds: ->get snmpv3 managers index userName authProt authPass privProt privPass status ========== 1 NoAuth - NoPriv - disabled 2 NoAuth - NoPriv - disabled 3 NoAuth - NoPriv - disabled 4 NoAuth - NoPriv - disabled 5 NoAuth - NoPriv - disabled Note: 1.Only maximum of 5 managers are allowed. If all the managers are filled in, remove 1 manager by overwriting the particular index.
get snmpv3 trap hosts	Displays a list of configured SNMPv3 trap hosts Note that only the Super user can view the ip addresses of trap hosts. Sequence: **get snmpv3 trap hosts** press Enter

Required Action	Steps
	The system responds: *# IpAddress UserName Auth Auth Priv Priv TrapHost* *Proto Passwd Proto Passwd Enabled* *= ============== ============== ===== ==========* *1 192.168.4.254 guest None - None - y* *2 0.0.0.0 None - None - n* *3 0.0.0.0 None - None - n* *4 0.0.0.0 None - None - n* *5 0.0.0.0 None - None - n*
set snmpv3 trap host ip	To set the trap host ip address to capture v3 traps. This will only set up a trap host destination without authentication or privacy. **NOTE:** You must set a trap host user (see next command) before a configured trap host will function. Only Super user is allowed to set these parameters. Sequence: **set snmpv3 trap host ip <index> <ipAddr>** press Enter where <index> indicates which trap host entry you want to set in the range of 1...5 and <ipAddr> is the ip address of the host on the network. The system responds: *Save mib and reboot Horizon Compact for changes to take effect.*
set snmpv3 trap host user	To set the host user name associated with v3 trap hosts. This will only set up a trap host destination without authentication or privacy. **NOTE:** You must set a trap host ip (see previous command) and a host user name before a configured trap host will function. Only Super user is allowed to set these parameters. Sequence: **set snmpv3 trap host user <index> <userName>** press Enter where <index> indicates which trap host ip address entry to which you want to add the host user name in the range of 1…5 The system responds: *Save mib and reboot Horizon Compact for changes to take effect.*

Required Action	Steps
set snmpv3 trap host enable	To enable a trap host. **NOTE:** Individual traps need to be enabed before they will be received by an enabled trap host. Only Super user is allowed to set these parameters. Sequence: **set snmpv3 trap host enable <index>** press Enter Where **<index>** is the trap host index you wish to enable in the range 1 to 5 The system responds: *Save mib and reboot Horizon Compact for changes to take effect.*
set snmpv3 trap host disable <index>	To disable a trap host. **NOTE:** Only Super user is allowed to set these parameters. Sequence: **set snmpv3 trap host disable <index>** press Enter Where **<index>** is the trap host index you wish to enable in the range 1 to 5 The system responds: *Save mib and reboot Horizon Compact for changes to take effect.*
set snmpv3 trap host authentication	Use this command to set up trap host authentication. **NOTE:** Only Super user is allowed to set these parameters. Sequence: **set snmpv3 trap host authentication <index> [none|md5|sha] <authKey>** press Enter Where **<index>** is the trap host index in the range 1 to 5 on which you wish to configure authentication, **[none|md5|sha]** are the protocols available and **<authKey>** is a text string of up to 25 alpha numeric characters. The system responds: *Save mib and reboot Horizon Compact for changes to take effect.*
set snmpV3 trap host privacy <index> [none|des] <privKey>	Use this command to set up privacy. **NOTE:** Authentication must be configured before privacy will function. Only Super user is allowed to set these parameters. Sequence: **set snmpV3 trap host privacy <index> [none|des] <privKey>** press Enter Where **<index>** is the trap host index in the range 1 to 5 on which you wish to configure privacy, **[none|des]** are the protocols available and **<privKey>** is a text string of up to 25 alpha numeric characters. The system responds: *Save mib and reboot Horizon Compact for changes to take effect.*

Required Action	Steps
save mib	Saves the MIB to RAM. Perform this command save setting changes to non-volatile memory. Sequence: **save mib** press Enter The system responds: *MIB saved successfully.*
reset system	Resets the system to save the settings to FLASH and restart the system with the new settings taking effect. Sequence: **reset system** press Enter The system responds: *Are you sure you want to reset? Y(yes) or N(no)* press **Y** The system will proceed to reset. You will have to log on again to regain access.

This concludes the steps to set up the SNMP for the Horizon Compact system.

5.1.2 Horizon Compact Enterprise Management Information Base (MIB)

A Management Information Base (MIB) contains information about a network device that is managed by SNMP. Horizon Compact supports industry standards MIB I and MIB II. In addition, DragonWave provides an enterprise MIB for Horizon Compact. For a list of objects and their definitions, refer to the Horizon Compact MIB definition file included with the DragonWave Toolkit CD-ROM.

You must load the Horizon Compact MIB onto your own MIB browser or Network Management Station (NMS). HP OpenView is an example of network management software to be used on the NMS. The Horizon Compact Enterprise MIB is provided in a standard MIB format that allows a more direct method of loading the definitions onto the NMS. On some NMS systems, it is as straightforward as placing the Horizon Compact MIB into the proper NMS directory and then enabling it by adding it to the MIB list. Please consult the instructions provided with your NMS for details on loading the Enterprise MIBs.

5.1.3 SNMP Traps

A trap is a message that reports a problem or a significant event. Traps are defined in the Horizon Compact MIB definition file. A trap destination or trap host is the IP address of a client (network management station) that receives the SNMP traps.

Procedure 5-2
Enable traps

Perform this procedure to enable traps.

Required Action	Steps
login	Log in as a NOC account
get snmp trap hosts	Displays a list of receivers of SNMP traps. Sequence: get snmp trap hosts press Enter The system responds: *Host# IpAddress Status CommunityString* *1 0.0.0.0 disabled public* *2 0.0.0.0 disabled public* *3 0.0.0.0 disabled public* *4 0.0.0.0 disabled public* *5 0.0.0.0 disabled public* **Note**: A maximum of 5 hosts is allowed. If all the hosts are filled in, remove 1 host by overwriting the particular index.

Required Action	Steps
set snmp trap host [host #] [ipAddress] [enable/disable] [communityString]	Adds an SNMP trap host to the list of receivers of SNMP traps. Specify the IP address where the system sends traps. Sequence: set snmp trap host [host #] [ipAddress] [enable/disable] [communityString] press Enter The system responds: *Host# IpAddress Status CommunityString* *1 0.0.0.0 disabled public* *2 0.0.0.0 disabled public* *3 3.3.3.3 enabled new text string here* *4 0.0.0.0 disabled public* *5 0.0.0.0 disabled public* **Note:** A maximum of 5 hosts are allowed. If all the hosts are filled in, remove 1 host by overwriting the particular index.

Required Action	Steps
get snmp traps	Displays the list of traps available in the system. Sequence: get snmp traps press Enter The system responds: *Trap# TrapName — Enabled(Yes | No)* *1 ColdStart — No* *2 WarmStart — No* *3 Link down — No* *4 Link up — No* *5 Explicit Authentication Failure — No* *6 AutoNeg Mismatched Duplex — No* *7 LossOfSignalLockFromDemod — No* *8 BerThresholdExceeded — No* *9 Mod PLL lock failure — No* *10 Mod loss of sync bytes — No* *11 Mod input FIFO overrun/underrun — No* *12 Mod input data inactivity — No* *13 SNR below threshold — No* *14 PLDRO lost lock — No* *15 Radio lost comm — No* *16 Radio mismatch — No* *17 IF Tx Synth Unlocked — No* *18 IF Rx Synth Unlocked — No* *19 TTY Session commenced — No* *20 TTY Session terminated — No* *21 RSL Below Threshold — No* *22 Dropped Frames Threshold exceeded — No* *23 Bandwidth Utilization Threshold exceeded — No* *24 Excessive Cable Loss — No*

Required Action	Steps
set snmp trap [trapIndex] [enable/disable]	Sets the SNMP trap and enables or disables it. DragonWave recommends enabling the LossOfSignalLockFromDemod trap. This trap indicates loss of communication with the peer Horizon Compact node. Sequence: set snmp trap [trapIndex] [enable/disable] press Enter The system responds: *Trap# TrapName — Enabled(Yes | No)* *1 ColdStart — No* *2 WarmStart — No* *3 Link down — No* *4 Link up — No* *5 Explicit Authentication Failure — No* *6 AutoNeg Mismatched Duplex — No* *7 LossOfSignalLockFromDemod — No* *8 BerThresholdExceeded — No* *9 Mod PLL lock failure — No* *10 Mod loss of sync bytes — No* *11 Mod input FIFO overrun/underrun — No* *12 Mod input data inactivity — No* *13 SNR below threshold — No* *14 PLDRO lost lock — No* *15 Radio lost comm — No* *16 Radio mismatch — No* *17 IF Tx Synth Unlocked — No* *18 IF Rx Synth Unlocked — No* *19 TTY Session commenced — No* *20 TTY Session terminated — No* *21 RSL Below Threshold — No* *22 Dropped Frames Threshold exceeded — No* *23 Bandwidth Utilization Threshold exceeded — No* *24 Excessive Cable Loss — No*

Required Action	Steps
save mib	Saves the MIB to RAM. Perform this command save setting changes to non-volatile memory. Sequence: **save mib** press Enter The system responds: *MIB saved successfully.*
reset system	Resets the system to save the settings to FLASH and restart the system with the new settings taking effect. Sequence: **reset system** press Enter The system responds: *Are you sure you want to reset? Y(yes) or N(no)* press **Y** The system will proceed to reset. You will have to log on again to regain access.

This concludes the steps to set SNMP traps using the CLI manager.

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Appendix A – CLI Command List

Command Syntax Summary (alpha order)

? (help)
copy [ftp:filename]
create ssl certificate
delete mib [newest|both]
delete radius server [index]
diagnose aam
downgrade system licensed speed [speed]
erase log
erase performance log
exit
get aam status
get alarms
get alarms counter
get alignment
get air interface authentication type
get antenna diameter
get atpc status
get authentication failure action
get authenticated peer
get authentication status
get backup ipconfig
get bandwidth utilization threshold
get bandwidth utilization status
get config commands
get cos default value
get cos expedite queue
get cos qinq itag
get cos qinq otag
get cos queue cir
get cos queue mapping
get cos queue cbs
get cos type
get date time
get default ipconfig
get default gateway
get dropped frames threshold
get enet address
get enet config
get enet speed
get enet status
get frequency bank
get frequency file crc
get frequency file status
get group authentication key
get health
get http secure access [Admin|Noc|Super]
get hw inventory
get ip address
get install type
get leds
get licensed speed count
get logging
get log entries
get maximum frame size
get modem modulation
get modem statistics
get network management interface
get network protocol strict
get omni file crc
get optical transmitter state
get pause state
get performance log
get performance logging
get performance log interval
get programmed frequency
get qos
get radio band
get radio loopback
get radio statistics
get radio status
get radio transmitter state
get radius servers
get radius server retransmit
get radius server timeout
get radius server deadtime
get radius super user authentication
get redundancy link monitor parameters
get redundancy mode
get redundancy override
get redundancy partner information
get redundancy secondary enet state
get redundancy status
get rls
get rls link enable
get rls link monitor parameters
get rls link control
get rls make rsl
get rls signal fault parameters
get rls status
get rsl threshold
get sessions
get snmp access mode
get snmp managers
get snmp set request
get snmp traps
get snmp trap hosts
get snmpv3 managers
get snmpv3 trap hosts
get snr threshold
get sntp
get sntp offset
get ssh server
get ssh server fingerprint
get ssl certificate status
get subnet mask
get super user
get sw inventory
get sw version
get system licensed speed downgrade information
get system mode
get system speed
get system summary
get system redundancy
get telnet access
get traffic statistics

get transmit power
get unique peer authentication key
get user accounts
get user session
get vlan tag
get vlan tagging
get web server
kill ssh sessions
list [ftp:file/directory/]
lo
ping [-w timeout][-n count][-t][ip address]
reset [system / modem]
save config [ftp:filename]
save log [ftp:filename]
save mib
save performance log [ftp:filename]
save users [ftp:filename]
set aam [on/off]
set admin user
set air interface authentication type [type]
set authentication failure [action]
set alarms counter [0]
set alignment [on/off]
set antenna diameter [index of diameter]
set atpc [on|off][coordinated power]
set bandwidth utilization threshold [threshold][time]
set cos default value [0-7]
set cos expedite queue [on|off]
set cos qinq itag [protocol id]
set cos qinq otag [protocol id]
set cos queue cir [0-100,0-100,0-100,1-100]
set cos queue mapping [mapping]
set cos queue cbs
set cos type [cos_vlan][cos_qinq_itag][cos_qinq_otag]
set current channel index
set date time [dd/mm/yyyy hh:mm:ss:ms]
set default gateway [ip address]
set dropped frames threshold [threshold][time]
set enet config [port1|port2]
set enet speed [port1|port2] speed[10|100|1000|auto]
AutoNeg[auto]
set frequency bank
set group authentication key [key]
set http secure access [Admin|Noc|Super] [on|off]
set ip address [address]
set logging [on|off]
set maximum frame size [1600-9600]
set network management interface [port1|port2| port2
extended]
set network protocol strict [on|off]
set noc user
set optical transmitter state [on|off]
set pause state [on|off]
set performance logging [on|off]
set performance log interval [hr:min:sec]
set programmed frequency [index]
set qos [on|off]
set radio transmitter state [enable|disable]
set radio band [band]
set radio loopback [on|off]
set radio rxgain
set radio txgain
set radius server key [index] [key]
set radius server host [index] [ip address]
set radius super user authentication strict [on|off]
set redundancy link monitor parameters
set redundancy mode
set redundancy override [primary|secondary|
manual|auto]
set redundancy standby enet state [on/off/pulse]
set redundancy state switch
set rls [on|off]
set rls link enable [on|off]
set rls link monitor parameters [dn2up frame error]
[up2dn frame error] [dn2up samples] [up2dn samples]
[sample time]
set rls link control [on|off]
set rls make rsl [rsl value][time]
set rls signal fault parameters [time][% error]
set rsl threshold [threshold][time]
set snmp access mode [v1|v2c|off]
set snmp manager [mgr index] [ip address]
[enable|disable] [community string]
set snmp set request [on|off]
set snmp trap [trap#] [enable|disable]
set snmp trap host [host#] [ip address]
[enable|disable] [community string]
set snr threshold [threshold]
set snmpv3 trap host enable [index]
set snmpv3 trap host disable [index]
set snmpv3 trap host ip [index] [ip address]
set snmpv3 trap host user [index] [none|des]
set snmpv3 trap host authentication [indes]
[none|md5|sha] [passwd]
set snmpv3 trap host privacy [index] [none|des]
set sntp [on|off]
set sntp default
set sntp offset [hrs]
set sntp server [index] [ip address]
set ssh server
set super user [username] [password]
set system current speed [speed]
set system mode [mode]
set system redundancy [on|off]
set telnet [on|off]
set traffic statistics [0]
set transmit power [power in dB]
set unique peer authentication key [key]
set subnet mask [mask]
set vlan tag [vlan ID (0-4095)] [vlan priority (0-7)]
set vlan tagging [on|off]
set web server [on|off]
upgrade system licensed speed [speed] [key]

Appendix B – Site Survey Information

Planning

When installing a microwave link, proper planning is required. Items to be addressed for proper planning include:

- RF path planning
- site preparation, including power and LAN connections
- installation issues for outdoor units including modem and Radio
- Governing body licensing issues (FCC, etc)
- Check local, regional, and national building and electrical codes
- lightning and ground protection
- surge protection
- use of outdoor cabling
- other radio system at the same frequency

Site Survey

A site visit must be done prior to installation to ensure proper line of sight path clearance exists and that proper facilities exist at the site according to the details listed below.

Line–of–Sight and Path Clearance. Determine optimum location for the radio. Radio and antenna location are important to ensure optimum radio range and throughput:

- Install the antenna as high as possible to maximize the range of a building-to-building connection
- Maintain a clear line–of–sight between Horizon Compact antennas. Obstructions can impede performance or limit ability to transmit or receive data. Reduced signal strength could affect performance; and
- Maintain maximum path clearance at both ends for the directional antennas.

When determining maximum path clearance, be aware of objects that restrict performance such as:

- Buildings
- Trees
- Rooftop objects such as a/c units
- Conductive metal surfaces
- standing pools of water
- edges of the roof (parapet) of the building on which the Horizon Compact is to be mounted.

Site Preparation

When you visit the site, be sure to record all installation requirements. You will need to determine the following:

- Other equipment in the area which can potentially interfere with the DragonWave Radios
- Ability to install the Horizon Compact units.
    - Facilities exist on which to mount the unit? (3" – 4" diameter pole/mast mount, tower mount, wall mount);
    - A mast or tower mount exists and is there sufficient room (clearance) to install the Horizon Compact unit;
    - The mast or tower has the ability to withstand wind load due to mounting of the Horizon Compact units;
    - Permits that may be required; and
    - Documentation required by building or site owner/landlord.
- Obstructions, such as tree growth or new buildings, that may be a problem in the future

If the Outdoor Unit (ODU) is being installed, the all-in-one cable will likely have to transit the outside wall and terminate on equipment located inside the building. If the Indoor Unit (Rack mount IDU) is being installed, the IF cable from the radio will likely have to transit the outside wall and terminate at the IDU. Determine the following:

- Cable distance between Horizon Compact and network equipment and the distance to the power source. DragonWave offers 3 lengths (30m, 60m, 90m).
- Location of building penetration point (drainage or service openings, elevator service sheds, other rooftop openings, or penetration through an outside wall).
- Size (diameter) of hole at the building access point. Check for other cables and clearance for Horizon Compact cables.

- Location of the nearest appropriate power outlet
- Location of the nearest ground bar or ground plane bus
- Power backup, such as Uninterruptible Power Supply (UPS)
- Location and ease of access to wiring closets
- Location and ease of access of network equipment (switch, router, etc)
- Grounding points for lightning arrestors and cable shields at building entry point
- Locations and grounding points for surge protectors.
- Check local electrical codes for requirements for lightning rods.
- If possible, ensure that Horizon Compact installations will be lower in height than existing lightning rods

Note: Record all installation requirements, including cable lengths, GPS co-ordinates (height, Lat., Long) and distance between the sites.

Appendix C - 802.1P Priority Tagging Overview

IEEE 802.1P The Institute of Electrical and Electronics Engineering (IEEE) 802.1P signaling method is used for traffic prioritization at OSI Reference Model Layer 2. 802.1p is a spin-off of the 802.1Q (Vlans) standard. Network adapters and switches route traffic based on the priority level for best-effort Quality of Service (QoS).

The 802.1Q VLAN standard specifies a VLAN tag that appends to a MAC frame. The VLAN tag has two parts: The VLAN ID (12-bit) and Prioritization (3-bit). The prioritization field was not defined in the VLAN standard and the 802.1P implementation defines this prioritization field.

To be compliant with 802.1p, Layer 2 switches must be capable of grouping incoming LAN packets into separate traffic classes.

Eight classes are defined by 802.1p. Although network managers must determine actual mappings, IEEE has made broad recommendations. The highest priority is seven, which might go to network-critical traffic such as interactive video and voice. Data classes four through one range from controlled-load applications such as streaming multimedia and business-critical traffic - carrying voice traffic, for instance - down to "loss eligible" traffic. The zero value is used as a best-effort default, invoked automatically when no other value has been set.

IP protocols can efficiently transport various data types over the same network resources. IP traffic is “bursty” in nature and requires flow control, buffering, and other mechanisms to deal with this “bursty” traffic when networks are heavily loaded. The performance attributes of time-sensitive traffic streams, such as voice and video conferencing, are of particular concern when implementing IP networks. The majority of time-sensitive traffic streams (VoIP, TDM over Ethernet, etc) do not have control protocols to negotiate speeds or re-transmits. Traffic is sent assuming delivery and ordering is unchanged.

Ethernet-based architectures require buffering capacity to absorb typical IP bursty traffic and to prevent packet loss to maintain Service Level Agreements (SLAs).

802.1P COS/QOS is used to accommodate bursty IP traffic

CoS vs QoS

What Is Quality of Service?

Quality of Service (QoS) is a traffic management scheme that allows you to create differentiated services for network traffic, thereby providing better service for selected network traffic.

QOS works by slowing down unimportant packets, or discarding those packets under high load. It therefore delivers the important packets, but at the expense of the unimportant packets.

QoS primarily comes into play when the amount of traffic through an interface is greater than the interface’s bandwidth.

When the traffic through an interface exceeds the bandwidth, packets form one or more Queues from which the device selects the next packet to send. By setting the queuing property on a device or interface, you can control how the Queues are serviced, thus determining the priority of the traffic.

What is Class of Service?

Class of Service (CoS) is an algorithm that tags packets then classifies those packets in order to assign them to Queues of differing priority. Unlike Quality of Service (QoS) traffic management, CoS does not ensure network performance or guarantee priority in delivering packets.

In summary: CoS = assigning priority values to data streams

QoS = traffic engineering to process data according to the priority values

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